


2017 Waste Composition Study

Final Report

June 2018

Prepared for the City and County of Honolulu

CASCADIA CONSULTING GROUP

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Executive Summary

Objectives

In 2017, the City and County of Honolulu (City) contracted with Cascadia Consulting Group (Cascadia) to conduct a composition study for municipal solid waste disposed of at H-POWER and the Waimanalo Gulch Landfill on the island of Oahu. The study included waste from four generating sectors—residential (collected at curbside from seven residential collection districts), commercial, residential self-haul, and commercial self-haul. This study is an update of two previous waste composition studies completed in 2006 and 2011.

Overview

Cascadia Consulting Group characterized a total of 312 samples: 204 samples of residential waste (including material from multifamily residents and bulky material set out at the curb), 40 samples of residential self-haul waste, 40 samples of commercial waste (collected by private haulers), and 28 samples of commercial self-haul waste.

Field work for this study took place over three weeks in July and August 2017. Additional bulky samples were characterized in September and October 2017. The field team hand-sorted all samples except for bulky residential loads, commercial self-haul loads, and residential self-haul loads from convenience centers. These loads were visually characterized instead of hand-sorted.

The project team combined the composition data (percentages by weight) from these sorts with annual quantity (tonnage) data provided by the City to generate the estimates presented throughout this report.

Key Findings

A summary of key findings from this study is presented below.

- **Overall—Organics** (36%) make up the largest portion of Honolulu's overall waste stream, followed by **Paper** (23%). The most prevalent material types are *food waste-non-vegetative* and *food waste-vegetative*, which, together, comprise one-fifth (20%) of the overall waste stream.
- **City-collected Residential**—The City-collected residential waste stream is composed primarily of **Organics**, which make up approximately 46% of this waste. The top three material types—*food waste-non-vegetative, green waste,* and *food waste-vegetative*—

together make up approximately one-third (33%) of this stream. **Paper** is the next most prevalent disposed material class in residential waste, making up about 22% of the total.

- **Residential Self-haul**—**Inerts and C&D** (40%) comprised the largest share of residential self-haul waste, followed by **Organics** (26%). The two most prevalent material types, *treated wood* (25%) and *green waste* (15%), together account for nearly 40 percent of this stream.
- **Privately-hauled Commercial**—Privately-hauled commercial waste was composed primarily of **Organics** (39%) and **Paper** (27%). The two predominant material categories—*food waste-non-vegetative* and *food waste-vegetative*—together account for more than one-quarter (27%) of this stream.
- **Commercial Self-haul**—As with residential self-haul waste, over two-thirds of commercial self-haul waste was comprised of **Other Materials** (68%). **Inerts and C&D** (17%) also made up a large share of this waste. The top two material categories—*auto fluff* and *sewage sludge*—accounted for almost 61% of commercial self-haul waste.

Introduction & Objectives

In 2017, the City and County of Honolulu contracted with Cascadia Consulting Group (Cascadia) to conduct a composition study for all municipal solid waste disposed at H-POWER and the Waimanalo Gulch Landfill on the island of Oahu. The study included waste from four generating sectors—residential (collected at curbside from seven residential collection districts), commercial, residential self-haul, and commercial self-haul. This study is an update of two previous waste composition studies completed in 2006 and 2011.

This report summarizes the methodology Cascadia used to conduct the composition study and presents key findings and waste composition results for Oahu overall and for each of the four generating sectors. The appendices that follow the main body of the report provide additional detail on the study, including material category definitions, a complete description of the methodology, detailed results by collection district and collection vehicle type, an explanation of composition calculations, and examples of field forms.

Summary of Methodology

Cascadia's approach to characterizing waste on the island of Oahu consisted of the following three steps:

1. Develop a sampling plan to ensure a statistically sound and efficient approach.
2. Collect composition data through a combination of hand-sort and visual characterization methods.
3. Analyze data and document findings of the study.

Each step of the study is summarized below. A full description of the study methodology is provided in Appendix B: Study Design, and an explanation of the calculations used in the analysis is included in Appendix D: Composition Calculations. Examples of the forms used to implement collection and sorting protocols are provided in Appendix E: Sample Field Forms.

Develop Sampling Plan

Before starting fieldwork, Cascadia developed a sampling plan that defined the material streams included in the study and the facilities from which the field crew would collect samples. Key elements of the sampling plan are described in detail below.

SAMPLING UNIVERSE

The sampling universe for this study included the following waste-generating sectors:

- **City-collected Residential**—waste generated by both single-family and a small number of multifamily dwellings throughout Oahu and collected by City-operated collection vehicles. For this study, residential waste was further split into ten subsectors:

Residential Subsector	*Description*
Honolulu	Automated routes collecting residential waste set out in gray carts at curbside in each of Oahu's seven collection districts
Kapaa	
Laie	
Pearl City	
Wahiawa	
Waialua	
Waianae	
3-cubic-yard bins (mostly multifamily)	Front loader routes collecting material from 3-cubic-yard bins generated primarily by small multifamily properties
Bulky collection	Rear loader routes collecting bulky item set-outs
Manual	Rear loaders on manual routes

- **Residential Self-haul**—waste from residential sources that is delivered to transfer stations, convenience centers, or the landfill by the resident or homeowner.
- **Privately-hauled Commercial**—waste primarily from institutional, commercial, or industrial sources and large multifamily dwellings that is collected by privately operated collection service providers and delivered primarily to H-POWER with a limited amount of the material passing through transfer stations or diverted to the landfill.
- **Commercial Self-haul**—waste from commercial sources that is delivered by the actual generator and delivered primarily to H-POWER. Although infrequent, this material is sometimes delivered to transfer stations or the landfill.

SAMPLE ALLOCATION

Cascadia conducted the study over three weeks in July and August in 2017. Additional bulky samples were characterized in September and October 2017. Table 1 below shows the planned and actual number of samples collected by the field crew by generating sector and subsector (collection district or route type).

Table 1: Number of Targeted and Actual Samples Collected and Sorted

Sector	Subsector (collection district or route type)	Planned Samples		Actual
		Visual	Hand-sort	
Residential	Honolulu		20	21
	Kapaa		20	21
	Laie		15	15
	Pearl City		20	20
	Wahiawa		15	16
	Waialua		15	14
	Waianae		15	15
	3-cubic-yard bins (mostly multifamily)		20	20
	Bulky collection	40		41
	Manual		20	21
Residential Self-haul		20*	20	20/20
Commercial			40	40
Commercial Self-haul		40		28
TOTAL		**100**	**220**	**312**

**Residential self-haul loads from convenience centers were visually characterized, while other residential self-haul loads were hand-sorted.*

Collect and Sort Samples

The process by which Cascadia selected, collected, and characterized samples is described in the sections that follow. Example forms used to conduct the study are provided in Appendix E: Sample Field Forms.

SITE COORDINATION AND SAMPLE SELECTION

Sampling took place at four sampling sites over the course of the study: H-POWER, Waimanalo Gulch Landfill, Keehi Transfer Station, and Kapaa Transfer Station.[1]

[1] Samples from Laie and Waialua were captured at the City's Kawailoa Transfer Station and transferred to one of the sampling sites for sorting.

Residential Waste

For each day of the study, Cascadia randomly selected routes for sampling from a complete list of waste routes that was provided by City staff. Cascadia selected routes to match the sampling targets for each collection district (Table 1).

Prior to sampling, Cascadia worked with City staff to distribute lists of pre-selected waste routes to collection yard supervisors. Brightly colored *Sample Placards* were also provided to drivers of selected routes to place on the dashboards of their trucks. When a selected vehicle arrived at the sampling facility, Cascadia's field supervisor collected the *Sample Placard* from the truck's windshield, verified the information noted on the *Sample Placard*, and directed the truck to the proper tipping location.

Commercial and Self-haul Waste

For this study, Cascadia selected commercial and self-haul loads using a systematic selection methodology (selecting every n^{th} vehicle) at the sampling facility on each day of field work. This method randomly selects individual vehicles from each sector for sampling. Using historical facility data, Cascadia calculated a sampling frequency (such as every third vehicle, every sixth vehicle, or every 20^{th} vehicle) for each day and sector in the study to determine which vehicles must be sampled to meet planned targets.

At H-POWER and the City's transfer stations, Cascadia trained scalehouse staff on the vehicle selection strategy and provided them with *Vehicle Selection Forms* for each day. The scalehouse staff used these *Vehicle Selection Forms* to select incoming vehicles for samples, with occasional instructional support from Cascadia staff when needed. Cascadia also prepared bright pink *Sample Placards*, which scalehouse staff placed on the windshield of vehicles that were selected. *Sample Placards* contained information about the sector and date for each load selected. Scalehouse staff then directed selected vehicles to the proper tipping location so the Cascadia team could obtain a sample from the load. At Waimanalo Gulch Landfill, a Cascadia crewmember, rather than scalehouse staff, selected vehicles as they arrived at the tipping face.

SAMPLE CHARACTERIZATION

The Cascadia field crew either hand-sorted or visually characterized samples, depending on the sector, collection district, and/or route type from which the sample was obtained. Bulky residential loads, commercial self-haul loads, and residential self-haul loads from convenience centers were visually characterized, and all other sample types were hand-sorted. The sections below describe the methodology for both approaches.

Hand-sort Methodology

After the selected vehicle dumped its load at the designated tipping location, the field supervisor superimposed a virtual 16-cell grid over the dumped material, identified a sample from a pre-selected random cell (noted on the *Sample Placard*), and received assistance from the disposal site's loader and operator to extract a sample from the load. The target weight for each sample was 200 to 250 pounds. Field crew staff photographed each sample, sorted the material into 60 different material categories, and recorded the weight for each sorted material category on the *Material Weight Tally Sheet*. Figure 1 provides a visual overview of this process.

Figure 1. Overview of Hand-sort Process

Visual Characterization

Cascadia characterized the entire tipped load for visually characterized samples (bulky material, commercial self-haul, and residential self-haul from convenience centers). After the selected vehicle unloaded its material, the field crew measured the entire load volume and photographed the load with the sample placard in place. The field crew staff then walked around the load, noting on the *Visual Characterization Form* what material classes were present in the load. Field crew staff then estimated the percentage by volume for each material class, beginning with the largest material class present, until all material classes recorded on the form summed to 100 percent. Next, the field crew considered each material class separately, estimating the

percentage of each material class that was made up of a specific material category (e.g., newspaper for the material class Paper). The field crew repeated this process for each material category in each material class present in the sample until the sum of recorded percentages for material categories in each material class summed to 100 percent. Volume estimates were converted to weights using industry-standard density factors during data analysis.[2]

Enter and Analyze Data

Cascadia field staff reviewed all field forms daily to identify any unusual or missing entries and resolved them immediately. After collecting the raw data in the field, staff entered all data into Cascadia's waste composition analysis database and conducted a quality analysis to identify and resolve errors. Cascadia then calculated waste composition estimates using the methods described in Appendix D: Composition Calculations. The project team developed detailed estimates of waste composition and quantities for each generating sector using the tonnage data the County provided and the methods described in Appendix D: Composition Calculations.

Results

This section presents characterization results for Oahu's waste stream. Waste characterization data are presented three ways:

- A pie chart presents an overview of material composition by material class.
- A table lists the ten most prevalent material categories by weight.
- A detailed table lists the full composition and quantity results for the 60 material categories.

Please refer to Appendix A: Material Category Definitions for detailed descriptions and definitions of each material category.

Material Designations

For clarity, broad material classes such as **Paper**, **Glass**, and **Metal** are bolded and capitalized while material categories such as *newspaper*, *paper bags,* and *HI-5 plastic PET containers* are italicized.

[2] The primary source for density factors was *CalRecycle's Method of Visual Characterization of Disposed Waste from Construction and Demolition Activities*, developed by Cascadia Consulting Group in 2006. http://www.calrecycle.ca.gov/publications/Documents/1224/34106010.pdf

Interpreting the Results

Cascadia analyzed the data from the sorting process to provide two types of information for each of the material categories:

- The estimated percent composition of waste by weight.
- The error range for the composition estimates at the 90 percent confidence level.

The example in Table 2 below illustrates how the results can be interpreted. The best estimate of the amount of *non-vegetative food waste* present in the overall waste stream is 12.5 percent. The 2.6 percent figure reflects the precision of the estimate. When calculations are performed at the 90 percent confidence level, we are 90 percent certain that the true mean for *non-vegetative food waste* is between 12.5 percent plus 2.6 percent and 12.5 percent minus 2.6 percent. In other words, we are 90 percent certain that the true mean lies between 9.9 percent and 15.1 percent.

Table 2. Example Percentage Composition and Error Range

Material	Est. Percent	+ / -
Food Waste—Non-Vegetative	12.5%	2.6%

ROUNDING

When interpreting the results presented in the tables and figures in this report, it is important to consider the effect of rounding.

To keep the waste composition tables and figures readable, estimated tonnages are rounded to the nearest ton, and estimated percentages are rounded to the nearest tenth of a percent. Due to rounding, the tonnages presented in the report, when added together, may not exactly match the subtotals and totals shown. Likewise, the percentages, when added together, may not exactly match the subtotals or totals shown. Finally, percentages less than 0.05 percent are rounded to 0.0 percent even though there may be weights associated with the material.

Disposed Quantities

Cascadia obtained tonnage data for each waste sector from City and County of Honolulu staff for September 2016 through August 2017. Annual disposed quantities for residential, commercial, residential self-haul, and commercial self-haul waste are shown in Table 3. Composition estimates were applied to the disposed quantities to obtain disposal weight estimates by material.

Table 3: Table of Waste Tonnages by Sector

Sector	Waste Tonnages (September 2016 – August 2017)
Residential	*328,924*
City-collected	266,528
Self-haul	62,397
Commercial	*465,444*
Privately-hauled	400,154
Self-haul	65,290
Total	**794,368**

Composition Results

OVERALL WASTE

Figure 2 presents composition estimates by material class for the overall waste stream. **Organics** is the largest material class present, accounting for over one-third (36%) of all disposed waste. **Paper** is the next-most predominant material class, accounting for approximately 23% of disposed waste in Oahu.

Figure 2: Overview of Overall Waste

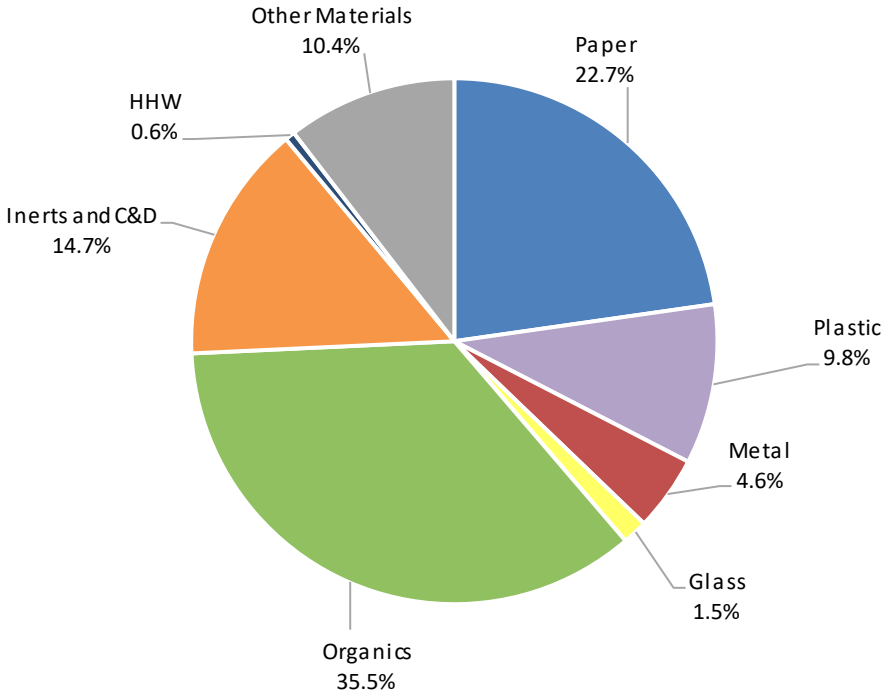


Table 4 shows the ten most prevalent materials in the overall waste stream. The top two material categories are both *food waste—food waste-non-vegetative* and *food waste-vegetative*. Together, these materials account for about one-fifth (20%) of overall disposed waste. *Uncoated corrugated cardboard* is the next-most prevalent material category, accounting for almost 7 percent of the waste stream.

Table 4: Ten Most Prevalent Material Categories in Overall Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	11.8%	11.8%	93,853
Food Waste-Vegetative	8.3%	20.1%	65,980
Uncoated Corrugated Cardboard	6.5%	26.7%	51,967
Green Waste	6.0%	32.7%	47,880
Pallets	5.9%	38.6%	46,722
Other Organics	5.8%	44.3%	45,875
Compostable Paper	5.7%	50.1%	45,660
Mixed Recyclable Paper	5.5%	55.5%	43,298
Other Plastic Film/Wrap	4.4%	60.0%	35,339
Treated Wood	3.4%	63.4%	27,042
Subtotal	***63.4%***		***503,616***
All other materials	36.6%		290,753
Total	**100.0%**		**794,368**

Table 5 presents detailed composition results for overall waste by material category.

Table 5. Detailed Waste Composition Results: Overall

Material	Estimated Percent	+/-	Estimated Tons	Material	Estimated Percent	+/-	Estimated Tons
Paper	**22.7%**		**180,645**	**Glass**	**1.5%**		**12,147**
Uncoated Corrugated Cardboard	6.5%	1.5%	51,967	HI-5 Glass Containers	0.5%	0.1%	3,756
Newspaper	1.5%	0.8%	12,070	Non-HI-5 Glass Containers	0.6%	0.2%	4,814
Paper Bags	0.6%	0.1%	5,131	Other Glass	0.5%	0.2%	3,578
White and Colored Ledger Paper	0.9%	0.3%	7,056				
Mixed Recyclable Paper	5.5%	1.1%	43,298	**Inerts and C&D Materials**	**14.7%**		**116,691**
Compostable Paper	5.7%	0.8%	45,660	Untreated Wood	1.6%	1.3%	12,634
Other Paper	1.9%	0.9%	15,462	Treated Wood	3.4%	1.1%	27,042
				Pallets	5.9%	3.1%	46,722
Plastic	**9.8%**		**78,137**	Gypsum Wallboard	0.7%	0.8%	5,325
HI-5 Plastic PET Containers	0.4%	0.1%	2,795	Asphalt Roofing	0.0%	0.0%	117
Non-HI-5 Plastic PET Containers	0.3%	0.0%	2,551	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	201	Concrete	0.1%	0.0%	749
Non-HI-5 Plastic HDPE Containers	0.6%	0.1%	4,391	Ceramics	0.4%	0.4%	3,483
Other Bottles/Containers	1.0%	0.2%	7,912	Sand/Soil/Rock/Dirt	0.1%	0.1%	887
Mixed Rigid/Durable Plastics	1.8%	0.4%	14,146	Other C&D Material	2.5%	1.2%	19,731
Plastic Bags	0.1%	0.0%	838				
Other Plastic Film/Wrap	4.4%	0.6%	35,339	**Household Hazardous Waste**	**0.6%**		**4,822**
Expanded Polystyrene	0.8%	0.2%	6,268	Pesticides/Herbicides	0.0%	0.0%	25
Other Plastic	0.5%	0.1%	3,698	Paints/Adhesives/Solvents	0.0%	0.0%	370
				Household Cleaners	0.0%	0.0%	145
Metal	**4.6%**		**36,662**	Other Automotive Products	0.1%	0.1%	526
HI-5 Aluminum Containers	0.2%	0.0%	1,372	Batteries	0.0%	0.0%	389
Non-HI-5 Aluminum Containers and Scrap	0.3%	0.1%	2,345	Other HHW	0.4%		3,366
HI-5 Bi-metal Containers	0.0%	0.0%	236				
Tin/Steel Containers	0.5%	0.1%	4,065	**Other Materials**	**10.4%**		**82,930**
Other Ferrous Metals	2.5%	1.1%	19,726	Sewage Sludge	2.5%		19,733
Other Non-Ferrous Metals	0.3%	0.2%	2,167	Sewage Screenings/Grit	0.2%		1,368
Other Metals	0.8%	0.2%	6,750	Industrial Sludges	0.2%		1,753
				Tires	0.1%	0.1%	828
Organics	**35.5%**		**282,334**	Furniture	1.2%	0.3%	9,652
Food Waste-Vegetative	8.3%	1.3%	65,980	Appliances	0.3%	0.3%	2,455
Food Waste-Non-Vegetative	11.8%		93,853	Covered Electronic Devices	1.1%	0.8%	8,723
Green Waste	6.0%	1.1%	47,880	Non-Covered Electronic Devices	0.1%	0.1%	1,064
Stumps	0.2%	0.1%	1,402	Auto Fluff	2.7%		21,756
Textiles	2.9%	0.5%	23,238	Mixed Residues	2.0%		15,598
Carpet	0.5%	0.4%	4,107				
Other Organics	5.8%		45,875	**Totals**	**100.0%**		**794,368**
				Sample Count			**312**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

For this substream, error rates (+/-) for certain materials cannot be calculated because additional weight data from scalehouse records was added to those special waste material types. Estimated percents and error rates that are provided in this table have been revised to adjust for the addition of scalehouse weight data.

RESIDENTIAL WASTE

Overall Residential Waste

This section presents results for overall residential waste. This includes residential waste set out at curbside in gray carts, material in 3-cubic-yard bins primarily collected from small multifamily properties, bulky items collected from rear loader routes, material collected by rear loaders on manual routes, and residential self-haul material.

As shown in Figure 3, **Organics** is the largest material class present in overall residential waste, making up over 42 percent of the stream. **Paper** is the next-most disposed material class, making up nearly one-fifth (19%) of residential waste.

Figure 3: Overview of Overall Residential Waste

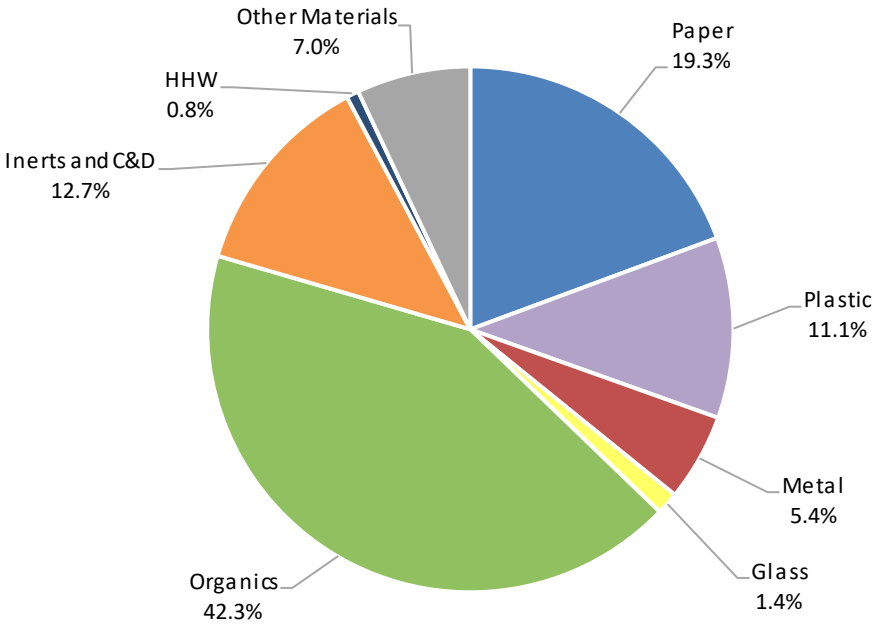


Table 6 lists the top ten material categories found in overall residential waste by weight. The three materials with the largest share are all in the **Organics** material class—*green waste*, *food waste-non-vegetative*, and *food waste-vegetative*—and together are nearly one-third (30%) of the stream.

Table 6: Ten Most Prevalent Material Categories in Overall Residential Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Green Waste	11.8%	11.8%	38,800
Food Waste-Non-Vegetative	10.5%	22.3%	34,484
Food Waste-Vegetative	8.0%	30.3%	26,223
Treated Wood	7.0%	37.2%	22,946
Other Organics	6.5%	43.8%	21,469
Mixed Recyclable Paper	6.5%	50.2%	21,232
Compostable Paper	6.2%	56.4%	20,385
Other Plastic Film/Wrap	4.7%	61.1%	15,520
Textiles	4.2%	65.3%	13,860
Uncoated Corrugated Cardboard	3.0%	68.4%	9,974
Subtotal	***68.4%***		***224,895***
All other materials	31.6%		104,030
Total	**100.0%**		**328,924**

Detailed results for overall residential waste by each of the 60 material categories are presented in Table 7.

Table 7: Detailed Waste Composition Results: Overall Residential

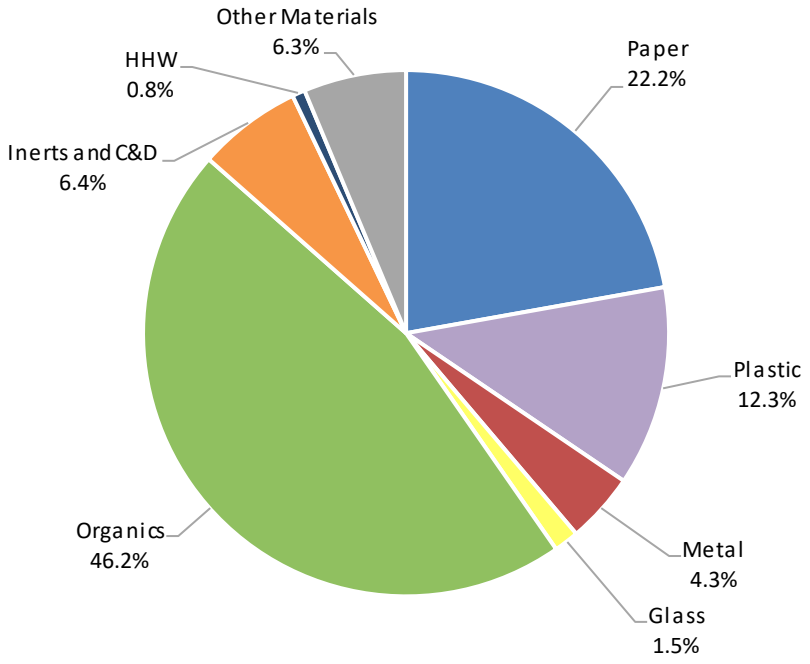
Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**19.3%**		**63,641**	**Glass**	**1.4%**		**4,531**
Uncoated Corrugated Cardboard	3.0%	0.5%	9,974	HI-5 Glass Containers	0.4%	0.1%	1,279
Newspaper	1.4%	0.2%	4,491	Non-HI-5 Glass Containers	0.6%	0.1%	2,101
Paper Bags	0.9%	0.1%	3,091	Other Glass	0.4%	0.2%	1,152
White and Colored Ledger Paper	0.5%	0.2%	1,700				
Mixed Recyclable Paper	6.5%	0.5%	21,232	**Inerts and C&D Materials**	**12.7%**		**41,849**
Compostable Paper	6.2%	0.5%	20,385	Untreated Wood	1.0%	0.3%	3,191
Other Paper	0.8%	0.2%	2,767	Treated Wood	7.0%	2.7%	22,946
				Pallets	1.3%	1.6%	4,313
Plastic	**11.1%**		**36,562**	Gypsum Wallboard	0.5%	0.3%	1,623
HI-5 Plastic PET Containers	0.3%	0.0%	1,088	Asphalt Roofing	0.0%	0.0%	125
Non-HI-5 Plastic PET Containers	0.4%	0.0%	1,294	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	24	Concrete	0.2%	0.1%	603
Non-HI-5 Plastic HDPE Containers	0.7%	0.1%	2,338	Ceramics	0.1%	0.0%	435
Other Bottles/Containers	1.1%	0.1%	3,781	Sand/Soil/Rock/Dirt	0.2%	0.1%	705
Mixed Rigid/Durable Plastics	2.2%	0.3%	7,101	Other C&D Material	2.4%	1.0%	7,908
Plastic Bags	0.1%	0.0%	360				
Other Plastic Film/Wrap	4.7%	0.3%	15,520	**Household Hazardous Waste**	**0.8%**		**2,504**
Expanded Polystyrene	0.7%	0.1%	2,255	Pesticides/Herbicides	0.0%	0.0%	27
Other Plastic	0.9%	0.3%	2,801	Paints/Adhesives/Solvents	0.1%	0.1%	394
				Household Cleaners	0.0%	0.0%	81
Metal	**5.4%**		**17,658**	Other Automotive Products	0.2%	0.1%	560
HI-5 Aluminum Containers	0.2%	0.0%	627	Batteries	0.1%	0.1%	306
Non-HI-5 Aluminum Containers and Scrap	0.4%	0.0%	1,314	Other HHW	0.3%	0.2%	1,137
HI-5 Bi-metal Containers	0.0%	0.0%	123				
Tin/Steel Containers	0.6%	0.1%	2,030	**Other Materials**	**7.0%**		**23,043**
Other Ferrous Metals	2.5%	0.7%	8,153	Sewage Sludge	0.0%	0.0%	26
Other Non-Ferrous Metals	0.4%	0.3%	1,360	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.2%	0.3%	4,052	Industrial Sludges	0.0%	0.0%	0
				Tires	0.3%	0.2%	881
Organics	**42.3%**		**139,136**	Furniture	2.4%	0.7%	7,993
Food Waste-Vegetative	8.0%	0.7%	26,223	Appliances	0.8%	0.8%	2,612
Food Waste-Non-Vegetative	10.5%	0.9%	34,484	Covered Electronic Devices	0.7%	0.2%	2,253
Green Waste	11.8%	2.5%	38,800	Non-Covered Electronic Devices	0.3%	0.1%	855
Stumps	0.5%	0.3%	1,492	Auto Fluff	0.0%	0.0%	48
Textiles	4.2%	0.9%	13,860	Mixed Residues	2.5%	0.3%	8,375
Carpet	0.9%	0.9%	2,808				
Other Organics	6.5%	1.0%	21,469	**Totals**	**100.0%**		**328,924**
				Sample Count			**244**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

City-collected Residential

Figure 4 presents the composition of City-collected residential waste by material class. City-collected residential waste includes material in curbside gray carts, material in 3-cubic-yard bins primarily collected from a small number of multifamily dwellings, and material collected on rear-loader manual and bulky item collection routes. The most common material class in city-collected residential waste is **Organics** (46% of this stream by weight), followed by **Paper** (22%).

Figure 4: Overview of City-collected Residential Waste



As shown in Table 8, the top three materials in city-collected residential waste—*food waste-non-vegetative, green waste,* and *food waste-vegetative*—are all **Organics**. Together, these materials make up approximately one-third (33%) of the stream.

Table 8: Ten Most Prevalent Material Categories in City-collected Residential Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	12.5%	12.5%	33,428
Green Waste	11.1%	23.7%	29,703
Food Waste-Vegetative	9.5%	33.2%	25,304
Other Organics	7.8%	41.0%	20,761
Mixed Recyclable Paper	7.5%	48.5%	20,091
Compostable Paper	7.4%	55.9%	19,720
Other Plastic Film/Wrap	5.5%	61.4%	14,709
Textiles	4.3%	65.7%	11,429
Mixed Residues	3.0%	68.7%	8,056
Uncoated Corrugated Cardboard	2.9%	71.7%	7,771
Subtotal	***71.7%***		***190,972***
All other materials	28.3%		75,556
Total	**100.0%**		**266,528**

Table 9 presents detailed composition results by material category.

Table 9: Detailed Waste Composition Results: City-collected Residential

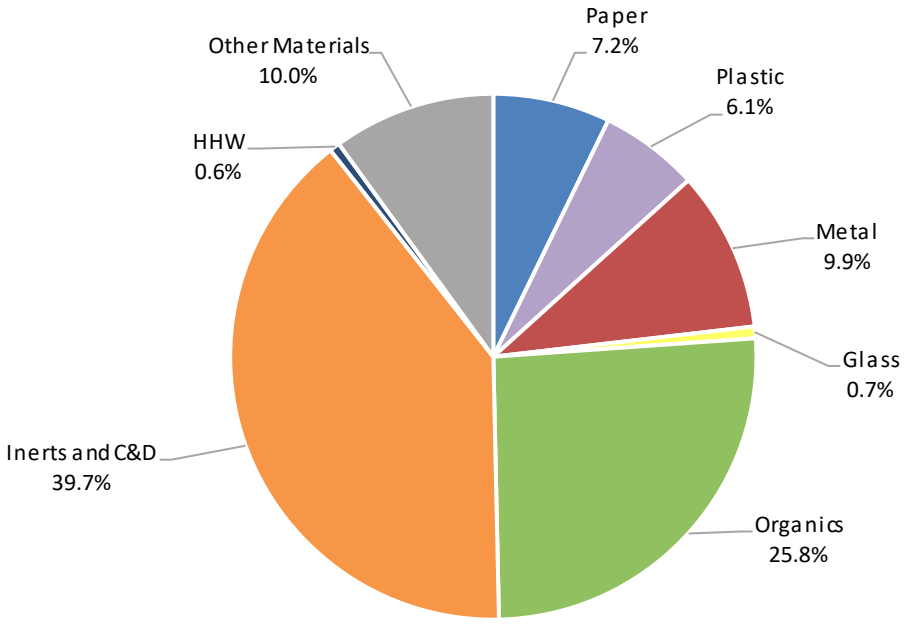
Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**22.2%**		**59,146**	**Glass**	**1.5%**		**4,080**
Uncoated Corrugated Cardboard	2.9%	0.3%	7,771	HI-5 Glass Containers	0.4%	0.1%	1,198
Newspaper	1.6%	0.3%	4,347	Non-HI-5 Glass Containers	0.8%	0.1%	2,028
Paper Bags	1.1%	0.1%	2,955	Other Glass	0.3%	0.1%	854
White and Colored Ledger Paper	0.6%	0.2%	1,622				
Mixed Recyclable Paper	7.5%	0.6%	20,091	**Inerts and C&D Materials**	**6.4%**		**17,065**
Compostable Paper	7.4%	0.5%	19,720	Untreated Wood	0.7%	0.2%	1,780
Other Paper	1.0%	0.2%	2,640	Treated Wood	2.8%	0.8%	7,398
				Pallets	0.0%	0.0%	123
Plastic	**12.3%**		**32,761**	Gypsum Wallboard	0.3%	0.2%	848
HI-5 Plastic PET Containers	0.4%	0.0%	1,040	Asphalt Roofing	0.0%	0.0%	116
Non-HI-5 Plastic PET Containers	0.5%	0.1%	1,234	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	22	Concrete	0.2%	0.1%	506
Non-HI-5 Plastic HDPE Containers	0.8%	0.1%	2,223	Ceramics	0.2%	0.1%	423
Other Bottles/Containers	1.4%	0.1%	3,622	Sand/Soil/Rock/Dirt	0.3%	0.1%	693
Mixed Rigid/Durable Plastics	2.1%	0.2%	5,528	Other C&D Material	1.9%	0.9%	5,179
Plastic Bags	0.1%	0.0%	346				
Other Plastic Film/Wrap	5.5%	0.3%	14,709	**Household Hazardous Waste**	**0.8%**		**2,107**
Expanded Polystyrene	0.8%	0.1%	2,143	Pesticides/Herbicides	0.0%	0.0%	22
Other Plastic	0.7%	0.2%	1,895	Paints/Adhesives/Solvents	0.1%	0.1%	327
				Household Cleaners	0.0%	0.0%	39
Metal	**4.3%**		**11,504**	Other Automotive Products	0.2%	0.2%	482
HI-5 Aluminum Containers	0.2%	0.0%	599	Batteries	0.1%	0.0%	177
Non-HI-5 Aluminum Containers and Scrap	0.5%	0.0%	1,266	Other HHW	0.4%	0.3%	1,061
HI-5 Bi-metal Containers	0.0%	0.0%	120				
Tin/Steel Containers	0.7%	0.1%	1,958	**Other Materials**	**6.3%**		**16,812**
Other Ferrous Metals	1.3%	0.2%	3,398	Sewage Sludge	0.0%	0.0%	25
Other Non-Ferrous Metals	0.2%	0.1%	586	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.3%	0.3%	3,576	Industrial Sludges	0.0%	0.0%	0
				Tires	0.1%	0.1%	389
Organics	**46.2%**		**123,052**	Furniture	1.7%	0.3%	4,426
Food Waste-Vegetative	9.5%	0.9%	25,304	Appliances	0.4%	0.3%	1,003
Food Waste-Non-Vegetative	12.5%	1.0%	33,428	Covered Electronic Devices	0.8%	0.2%	2,041
Green Waste	11.1%	1.6%	29,703	Non-Covered Electronic Devices	0.3%	0.1%	834
Stumps	0.6%	0.4%	1,480	Auto Fluff	0.0%	0.0%	38
Textiles	4.3%	0.9%	11,429	Mixed Residues	3.0%	0.4%	8,056
Carpet	0.4%	0.2%	947				
Other Organics	7.8%	1.2%	20,761	**Totals**	**100.0%**		**266,528**
				Sample Count			**204**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Residential Self-haul

Figure 5 presents a breakdown of residential self-haul waste by material class. Nearly 40 percent of this stream is **Inerts and C&D**. The second-most common material class in residential self-haul waste is **Organics** (26%).

Figure 5: Overview of Residential Self-haul Waste



As shown in Table 10, the two most prevalent material categories in residential self-haul waste are *treated wood* (25%) and *green waste* (15%), which together account for nearly 40 percent of the stream.

Table 10: Ten Most Prevalent Material Categories in Residential Self-haul Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Treated Wood	24.9%	24.9%	15,548
Green Waste	14.6%	39.5%	9,097
Other Ferrous Metals	7.6%	47.1%	4,754
Pallets	6.7%	53.8%	4,190
Furniture	5.7%	59.5%	3,567
Other C&D Material	4.4%	63.9%	2,729
Textiles	3.9%	67.8%	2,431
Uncoated Corrugated Cardboard	3.5%	71.4%	2,203
Carpet	3.0%	74.3%	1,860
Appliances	2.6%	76.9%	1,609
Subtotal	***76.9%***		***47,990***
All other materials	23.1%		14,407
Total	**100.0%**		**62,397**

Table 11 presents detailed composition results by material category.

Table 11: Detailed Waste Composition Results: Residential Self-haul

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**7.2%**		**4,494**	**Glass**	**0.7%**		**452**
Uncoated Corrugated Cardboard	3.5%	2.6%	2,203	HI-5 Glass Containers	0.1%	0.1%	81
Newspaper	0.2%	0.2%	143	Non-HI-5 Glass Containers	0.1%	0.1%	73
Paper Bags	0.2%	0.1%	136	Other Glass	0.5%	0.7%	298
White and Colored Ledger Paper	0.1%	0.1%	78				
Mixed Recyclable Paper	1.8%	1.0%	1,141	**Inerts and C&D Materials**	**39.7%**		**24,784**
Compostable Paper	1.1%	0.7%	665	Untreated Wood	2.3%	1.4%	1,411
Other Paper	0.2%	0.1%	127	Treated Wood	24.9%	13.6%	15,548
				Pallets	6.7%	8.3%	4,190
Plastic	**6.1%**		**3,801**	Gypsum Wallboard	1.2%	1.3%	775
HI-5 Plastic PET Containers	0.1%	0.0%	48	Asphalt Roofing	0.0%	0.0%	9
Non-HI-5 Plastic PET Containers	0.1%	0.1%	60	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	2	Concrete	0.2%	0.2%	97
Non-HI-5 Plastic HDPE Containers	0.2%	0.1%	116	Ceramics	0.0%	0.0%	12
Other Bottles/Containers	0.3%	0.1%	159	Sand/Soil/Rock/Dirt	0.0%	0.0%	12
Mixed Rigid/Durable Plastics	2.5%	1.3%	1,572	Other C&D Material	4.4%	3.4%	2,729
Plastic Bags	0.0%	0.0%	14				
Other Plastic Film/Wrap	1.3%	0.9%	811	**Household Hazardous Waste**	**0.6%**		**397**
Expanded Polystyrene	0.2%	0.1%	112	Pesticides/Herbicides	0.0%	0.0%	5
Other Plastic	1.5%	1.2%	907	Paints/Adhesives/Solvents	0.1%	0.1%	67
				Household Cleaners	0.1%	0.1%	42
Metal	**9.9%**		**6,154**	Other Automotive Products	0.1%	0.2%	78
HI-5 Aluminum Containers	0.0%	0.0%	28	Batteries	0.2%	0.3%	129
Non-HI-5 Aluminum Containers and Scrap	0.1%	0.0%	48	Other HHW	0.1%	0.1%	76
HI-5 Bi-metal Containers	0.0%	0.0%	4				
Tin/Steel Containers	0.1%	0.1%	71	**Other Materials**	**10.0%**		**6,231**
Other Ferrous Metals	7.6%	3.8%	4,754	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	1.2%	1.6%	773	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	0.8%	0.4%	476	Industrial Sludges	0.0%	0.0%	0
				Tires	0.8%	0.8%	492
Organics	**25.8%**		**16,084**	Furniture	5.7%	3.6%	3,567
Food Waste-Vegetative	1.5%	0.9%	919	Appliances	2.6%	4.1%	1,609
Food Waste-Non-Vegetative	1.7%	1.2%	1,056	Covered Electronic Devices	0.3%	0.3%	212
Green Waste	14.6%	11.3%	9,097	Non-Covered Electronic Devices	0.0%	0.0%	22
Stumps	0.0%	0.0%	12	Auto Fluff	0.0%	0.0%	10
Textiles	3.9%	3.1%	2,431	Mixed Residues	0.5%	0.3%	319
Carpet	3.0%	4.9%	1,860				
Other Organics	1.1%	0.7%	709	**Totals**	**100.0%**		**62,397**
				Sample Count			**40**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

COMMERCIAL WASTE

Overall Commercial Waste

This section presents composition data for overall commercial waste—including both privately-hauled and self-haul waste from businesses, institutions, and large condos. As shown in Figure 6, almost one third of this stream is **Organics** (31%). The next largest material class found in commercial waste is **Paper** (25%).

Figure 6: Overview of Overall Commercial Waste

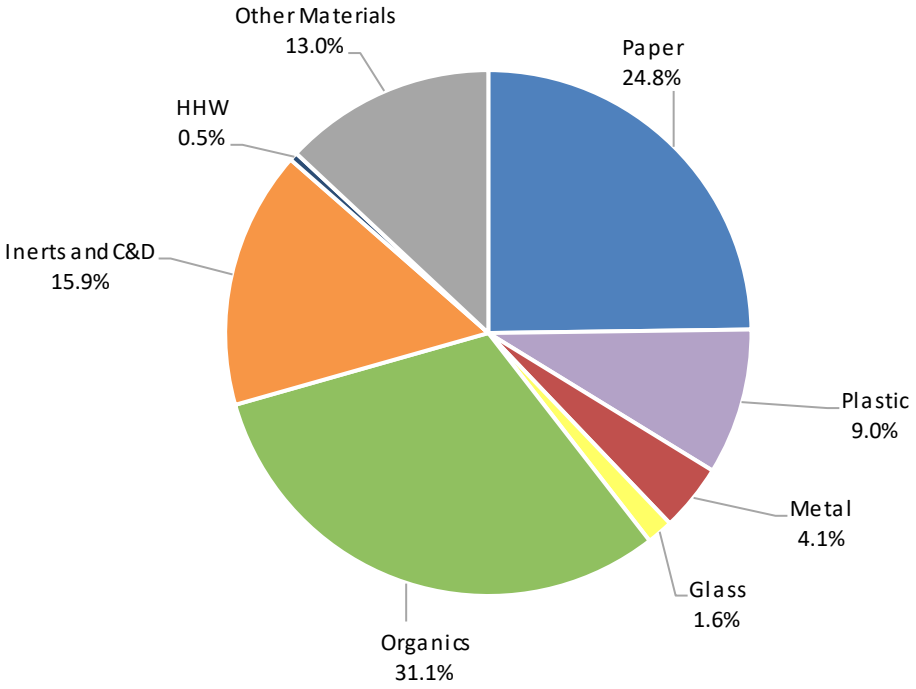


Table 12 lists the ten predominant material categories in commercial waste. The most prevalent material is *food waste-non-vegetative* (13%), followed by *pallets* (9%), *uncoated corrugated cardboard* (9%), and *food waste-vegetative* (9%). Together, these materials account for nearly 40 percent of commercial waste by weight.

Table 12: Ten Most Prevalent Material Categories in Overall Commercial Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	12.6%	12.6%	58,687
Pallets	8.8%	21.4%	40,737
Uncoated Corrugated Cardboard	8.7%	30.1%	40,665
Food Waste-Vegetative	8.5%	38.6%	39,464
Compostable Paper	5.4%	44.0%	25,303
Other Organics	5.3%	49.3%	24,542
Mixed Recyclable Paper	4.8%	54.1%	22,287
Auto Fluff	4.7%	58.7%	21,702
Other Plastic Film/Wrap	4.3%	63.0%	19,814
Sewage Sludge	4.2%	67.2%	19,709
Subtotal	***67.2%***		***312,910***
All other materials	32.8%		152,534
Total	**100.0%**		**465,444**

Table 13 presents detailed composition results by material category.

Table 13: Detailed Waste Composition Results: Overall Commercial

Material	Estimated Percent	+/-	Estimated Tons	Material	Estimated Percent	+/-	Estimated Tons
Paper	**24.8%**		**115,365**	**Glass**	**1.6%**		**7,532**
Uncoated Corrugated Cardboard	8.7%	2.4%	40,665	HI-5 Glass Containers	0.5%	0.2%	2,438
Newspaper	1.6%	1.3%	7,495	Non-HI-5 Glass Containers	0.6%	0.2%	2,711
Paper Bags	0.5%	0.1%	2,125	Other Glass	0.5%	0.3%	2,383
White and Colored Ledger Paper	1.1%	0.5%	5,211				
Mixed Recyclable Paper	4.8%	1.8%	22,287	**Inerts and C&D Materials**	**15.9%**		**73,858**
Compostable Paper	5.4%	1.3%	25,303	Untreated Wood	2.0%	2.1%	9,199
Other Paper	2.6%	1.5%	12,279	Treated Wood	1.1%	0.5%	5,230
				Pallets	8.8%	5.0%	40,737
Plastic	**9.0%**		**41,794**	Gypsum Wallboard	0.8%	1.2%	3,627
HI-5 Plastic PET Containers	0.4%	0.1%	1,692	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.3%	0.1%	1,274	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	170	Concrete	0.0%	0.1%	174
Non-HI-5 Plastic HDPE Containers	0.4%	0.1%	2,094	Ceramics	0.6%	0.7%	2,935
Other Bottles/Containers	0.9%	0.3%	4,161	Sand/Soil/Rock/Dirt	0.0%	0.1%	214
Mixed Rigid/Durable Plastics	1.5%	0.6%	7,135	Other C&D Material	2.5%	1.9%	11,742
Plastic Bags	0.1%	0.0%	477				
Other Plastic Film/Wrap	4.3%	1.0%	19,814	**Household Hazardous Waste**	**0.5%**		**2,377**
Expanded Polystyrene	0.9%	0.4%	3,961	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.2%	0.1%	1,017	Paints/Adhesives/Solvents	0.0%	0.0%	0
				Household Cleaners	0.0%	0.0%	66
Metal	**4.1%**		**19,159**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.2%	0.1%	748	Batteries	0.0%	0.0%	97
Non-HI-5 Aluminum Containers and Scrap	0.2%	0.1%	1,060	Other HHW	0.5%		2,214
HI-5 Bi-metal Containers	0.0%	0.0%	115				
Tin/Steel Containers	0.4%	0.1%	2,060	**Other Materials**	**13.0%**		**60,614**
Other Ferrous Metals	2.5%	1.7%	11,518	Sewage Sludge	4.2%		19,709
Other Non-Ferrous Metals	0.2%	0.2%	849	Sewage Screenings/Grit	0.3%		1,368
Other Metals	0.6%	0.3%	2,809	Industrial Sludges	0.4%		1,753
				Tires	0.0%	0.0%	0
Organics	**31.1%**		**144,744**	Furniture	0.4%	0.3%	2,043
Food Waste-Vegetative	8.5%	2.1%	39,464	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	12.6%		58,687	Covered Electronic Devices	1.4%	1.3%	6,307
Green Waste	2.3%	1.0%	10,899	Non-Covered Electronic Devices	0.1%	0.1%	249
Stumps	0.0%	0.0%	0	Auto Fluff	4.7%		21,702
Textiles	2.1%	0.7%	9,750	Mixed Residues	1.6%		7,483
Carpet	0.3%	0.3%	1,402				
Other Organics	5.3%		24,542	**Totals**	**100.0%**		**465,444**
				Sample Count			**68**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

For this substream, error rates (+/-) for certain materials cannot be calculated because additional weight data from scalehouse records was added to those special waste material types. Estimated percents and error rates that are provided in this table have been revised to adjust for the addition of scalehouse weight data.

Privately-hauled Commercial Waste

The composition of commercial waste collected by private haulers (e.g., Honolulu Disposal, WOA, Perry Management, and Aloha Waste) by material class is presented in Figure 7. The most common material class in privately-hauled commercial waste is **Organics** (39%), followed by **Paper** (27%) and **Inerts and C&D** (13%).

Figure 7: Overview of Privately-hauled Commercial Waste

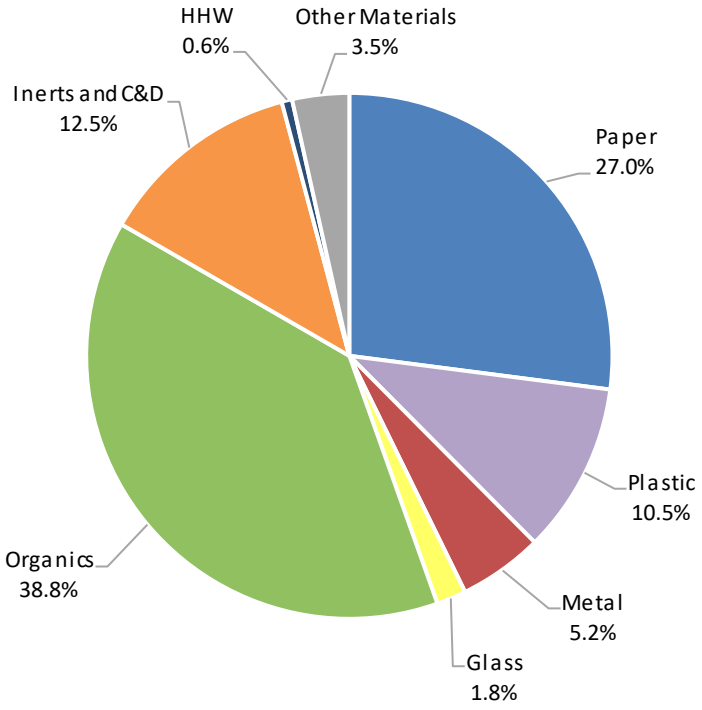


Table 14 lists the ten material categories that make up the largest share of privately-hauled commercial waste. The two most prevalent material categories—*food waste-non-vegetative* and *food waste-vegetative*—together account for more than one-quarter (27%) of this stream. The next-most prevalent material categories found in privately-hauled commercial waste are *uncoated corrugated cardboard* (9%) and *pallets* (7%).

Table 14: Ten Most Prevalent Material Categories in Privately-hauled Commercial Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	16.0%	16.0%	64,000
Food Waste-Vegetative	10.8%	26.8%	43,244
Uncoated Corrugated Cardboard	8.6%	35.4%	34,246
Pallets	7.1%	42.5%	28,499
Compostable Paper	6.7%	49.2%	26,795
Other Organics	6.2%	55.4%	24,762
Mixed Recyclable Paper	6.0%	61.3%	23,828
Other Plastic Film/Wrap	5.3%	66.7%	21,348
Other Ferrous Metals	3.1%	69.8%	12,519
Green Waste	3.0%	72.8%	11,913
Subtotal	***72.8%***		***291,155***
All other materials	27.2%		109,000
Total	**100.0%**		**400,154**

Table 15 presents detailed waste composition results for privately-hauled commercial waste.

Table 15: Detailed Waste Composition Results: Privately-hauled Commercial

Material	Estimated Percent	+/-	Estimated Tons	Material	Estimated Percent	+/-	Estimated Tons
Paper	**27.0%**		**108,240**	**Glass**	**1.8%**		**7,280**
Uncoated Corrugated Cardboard	8.6%	2.8%	34,246	HI-5 Glass Containers	0.6%	0.3%	2,577
Newspaper	2.0%	1.6%	8,180	Non-HI-5 Glass Containers	0.7%	0.3%	2,928
Paper Bags	0.6%	0.2%	2,283	Other Glass	0.4%	0.4%	1,774
White and Colored Ledger Paper	1.3%	0.7%	5,238				
Mixed Recyclable Paper	6.0%	2.3%	23,828	**Inerts and C&D Materials**	**12.5%**		**50,123**
Compostable Paper	6.7%	1.6%	26,795	Untreated Wood	2.5%	2.6%	10,044
Other Paper	1.9%	0.7%	7,669	Treated Wood	1.1%	0.7%	4,545
				Pallets	7.1%	5.9%	28,499
Plastic	**10.5%**		**42,039**	Gypsum Wallboard	0.0%	0.0%	0
HI-5 Plastic PET Containers	0.5%	0.1%	1,811	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.3%	0.1%	1,359	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.1%	184	Concrete	0.0%	0.0%	0
Non-HI-5 Plastic HDPE Containers	0.6%	0.2%	2,289	Ceramics	0.3%	0.3%	1,059
Other Bottles/Containers	1.1%	0.3%	4,516	Sand/Soil/Rock/Dirt	0.0%	0.0%	0
Mixed Rigid/Durable Plastics	1.5%	0.4%	5,901	Other C&D Material	1.5%	1.6%	5,975
Plastic Bags	0.1%	0.0%	518				
Other Plastic Film/Wrap	5.3%	1.2%	21,348	**Household Hazardous Waste**	**0.6%**		**2,570**
Expanded Polystyrene	0.8%	0.4%	3,222	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.2%	0.1%	893	Paints/Adhesives/Solvents	0.0%	0.0%	0
				Household Cleaners	0.0%	0.0%	73
Metal	**5.2%**		**20,782**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.2%	0.1%	815	Batteries	0.0%	0.0%	107
Non-HI-5 Aluminum Containers and Scrap	0.3%	0.1%	1,166	Other HHW	0.6%		2,391
HI-5 Bi-metal Containers	0.0%	0.0%	124				
Tin/Steel Containers	0.6%	0.2%	2,250	**Other Materials**	**3.5%**		**13,993**
Other Ferrous Metals	3.1%	2.2%	12,519	Sewage Sludge	0.4%		1,540
Other Non-Ferrous Metals	0.2%	0.3%	915	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	0.7%	0.3%	2,993	Industrial Sludges	0.2%		915
				Tires	0.0%	0.0%	0
Organics	**38.8%**		**155,127**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	10.8%	2.7%	43,244	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	16.0%		64,000	Covered Electronic Devices	1.1%	1.4%	4,526
Green Waste	3.0%	1.3%	11,913	Non-Covered Electronic Devices	0.1%	0.1%	273
Stumps	0.0%	0.0%	0	Auto Fluff	0.1%	0.1%	218
Textiles	2.4%	0.8%	9,740	Mixed Residues	1.6%		6,520
Carpet	0.4%	0.4%	1,467				
Other Organics	6.2%	4.4%	24,762	**Totals**	**100.0%**		**400,154**
				Sample Count			**40**

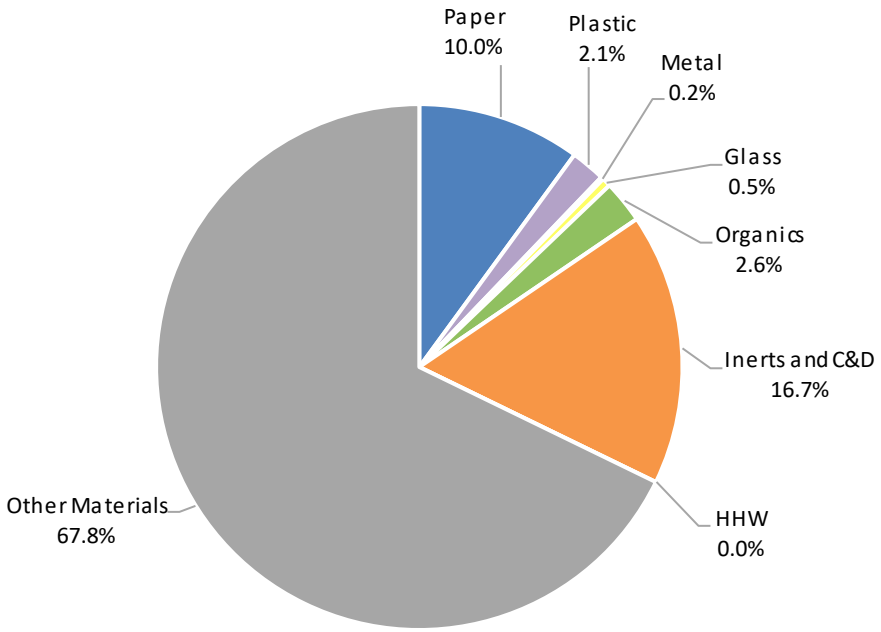
Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

For this substream, error rates (+/-) for certain materials cannot be calculated because additional weight data from scalehouse records was added to those special waste material types. Estimated percents and error rates that are provided in this table have been revised to adjust for the addition of scalehouse weight data.

Commercial Self-haul

Figure 8 presents composition results by material class for waste self-hauled by commercial generators to H-POWER, transfer stations, and the landfill. **Other Materials** is the largest material class in this stream, making up more than two-thirds (68%) of commercial self-haul waste by weight. **Inerts and C&D**, which is almost 17 percent of commercial self-haul waste, is the next largest material class.

Figure 8: Overview of Commercial Self-haul Waste



As presented in Table 16, the top two material categories—*auto fluff* and *sewage sludge*—accounted for over 60 percent of commercial self-haul waste.

Table 16: Ten Most Prevalent Material Categories in Commercial Self-haul Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Auto Fluff	32.9%	32.9%	21,504
Sewage Sludge	27.8%	60.8%	18,169
Pallets	8.8%	69.5%	5,725
Uncoated Corrugated Cardboard	5.6%	75.2%	3,681
Other C&D Material	3.7%	78.9%	2,436
Other Paper	3.1%	82.0%	2,049
Gypsum Wallboard	2.1%	84.2%	1,400
Sewage Screenings/Grit	2.1%	86.3%	1,368
Other Organics	1.4%	87.6%	889
Covered Electronic Devices	1.3%	88.9%	846
Subtotal	***88.9%***		***58,069***
All other materials	11.1%		7,221
Total	**100.0%**		**65,290**

Table 17 presents detailed waste composition results for commercial self-haul waste.

Table 17: Detailed Waste Composition Results: Commercial Self-haul

Material	Estimated Percent	+/-	Estimated Tons	Material	Estimated Percent	+/-	Estimated Tons
Paper	**10.0%**		**6,555**	**Glass**	**0.5%**		**353**
Uncoated Corrugated Cardboard	5.6%	2.9%	3,681	HI-5 Glass Containers	0.1%	0.1%	37
Newspaper	0.0%	0.1%	23	Non-HI-5 Glass Containers	0.0%	0.0%	19
Paper Bags	0.0%	0.0%	19	Other Glass	0.5%	0.4%	297
White and Colored Ledger Paper	0.3%	0.3%	174				
Mixed Recyclable Paper	0.4%	0.3%	243	**Inerts and C&D Materials**	**16.7%**		**10,923**
Compostable Paper	0.6%	0.6%	366	Untreated Wood	0.0%	0.0%	27
Other Paper	3.1%	4.0%	2,049	Treated Wood	0.6%	0.4%	424
				Pallets	8.8%	5.3%	5,725
Plastic	**2.1%**		**1,383**	Gypsum Wallboard	2.1%	3.4%	1,400
HI-5 Plastic PET Containers	0.0%	0.0%	18	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.0%	0.0%	15	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	1	Concrete	0.1%	0.2%	67
Non-HI-5 Plastic HDPE Containers	0.0%	0.0%	5	Ceramics	1.2%	1.7%	761
Other Bottles/Containers	0.0%	0.0%	22	Sand/Soil/Rock/Dirt	0.1%	0.2%	83
Mixed Rigid/Durable Plastics	1.0%	1.4%	683	Other C&D Material	3.7%	4.1%	2,436
Plastic Bags	0.0%	0.0%	3				
Other Plastic Film/Wrap	0.2%	0.2%	158	**Household Hazardous Waste**	**0.0%**		**0**
Expanded Polystyrene	0.6%	0.7%	398	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.1%	0.1%	79	Paints/Adhesives/Solvents	0.0%	0.0%	0
				Household Cleaners	0.0%	0.0%	0
Metal	**0.2%**		**104**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.0%	0.0%	3	Batteries	0.0%	0.0%	0
Non-HI-5 Aluminum Containers and Scrap	0.0%	0.0%	0	Other HHW	0.0%	0.0%	0
HI-5 Bi-metal Containers	0.0%	0.0%	1				
Tin/Steel Containers	0.0%	0.0%	6	**Other Materials**	**67.8%**		**44,259**
Other Ferrous Metals	0.1%	0.1%	54	Sewage Sludge	27.8%		18,169
Other Non-Ferrous Metals	0.0%	0.0%	7	Sewage Screenings/Grit	2.1%		1,368
Other Metals	0.1%	0.0%	34	Industrial Sludges	1.3%		837
				Tires	0.0%	0.0%	0
Organics	**2.6%**		**1,713**	Furniture	1.2%	0.9%	789
Food Waste-Vegetative	0.1%	0.1%	61	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	0.6%		363	Covered Electronic Devices	1.3%	1.5%	846
Green Waste	0.0%	0.0%	27	Non-Covered Electronic Devices	0.0%	0.0%	0
Stumps	0.0%	0.0%	0	Auto Fluff	32.9%		21,504
Textiles	0.5%	0.4%	346	Mixed Residues	1.1%		745
Carpet	0.0%	0.1%	26				
Other Organics	1.4%		889	**Totals**	**100.0%**		**65,290**
				Sample Count			**28**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

For this substream, error rates (+/-) for certain materials cannot be calculated because additional weight data from scalehouse records was added to those special waste material types. Estimated percents and error rates that are provided in this table have been revised to adjust for the addition of scalehouse weight data.

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Appendix A: Material Category Definitions

Samples were sorted into the 60 material categories named and defined below. HI-5 labels are usually located on the top of aluminum cans and the container label on the plastic and glass bottles.

PAPER

1. **Uncoated Corrugated Cardboard**: Old corrugated container (OCC) boxes. Corrugated cardboard means a paper laminate usually composed of three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. Examples include entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This type also includes very clean (no food residue and only lightly stained) pizza boxes. This type does not include single layer chipboard boxes such as cereal and tissue boxes.

2. **Newspaper**: Paper used in newspapers. Examples include all non-glossy newspapers, newspaper inserts, and all items made from newsprint, such as free advertising guides, election guides, and tax instruction booklets. Glossy inserts found in newspapers are not included in this material.

3. **Paper Bags:** Bags and sheets made from Kraft paper. The paper may be brown (unbleached) or white (bleached). Examples include paper grocery bags, clean fast food bags, department store bags, and heavyweight sheets of Kraft packing paper.

4. **White and Colored Ledger Paper**: Colored or white bond, rag, or stationery grade paper, without ground wood fibers. It may have colored ink on it. Examples include white and colored paper used in photocopiers and laser printers, and letter paper. Envelopes, junk mail, magazines, and shredded paper are not included in this material.

5. **Mixed Recyclable Paper**: Other types of paper that are typically considered recyclable in continental U.S. residential curbside. This type includes manila folders, manila envelopes, index cards, white envelopes, white window envelopes, white or colored notebook paper, ground wood computer paper, junk mail, and carbonless forms. This type also includes magazines, catalogs, whole or damaged phone books, and other miscellaneous types of mixed paper, like cereal and cracker boxes, unused paper plates and cups, frozen food boxes, self-adhesive notes, and hard cover and soft cover books. This type also includes polycoated gable tops (e.g., half-gallon milk cartons).

6. **Compostable Paper**: Items made mostly of paper that could be composted and that do not fit into any of the other paper types. Paper may be combined with minor amounts of other materials such as wax or glues. Examples include pulp paper egg cartons, unused pulp paper plant pots, molded paper packing materials, some berry trays, some take-out food containers, dirty molded paper plates, waxed corrugated cardboard, waxed paper, napkins, tissue, paper towels, fast food wrappers, food-soiled paper and moisture-soiled paper, all pizza boxes (unless at least 95 percent clean), and shredded paper.

7. **Other Paper:** Items made mostly of paper but combined with large amounts of other materials. These are items that do not fit into any other types and are not generally compostable or recyclable. Examples include blueprints, sepia, carbon paper, photographs, paper frozen juice cans, ice cream cartons, sheets of paper stick-on labels, and paper mailing envelopes lined with bubble wrap or plastic.

PLASTIC

8. **HI-5 Plastic PET Containers**: PET (polyethylene terephthalate) clear or colored containers that display the HI-5 notification and are unbroken. When marked for identification, it bears the number "1" in the center of the triangular recycling symbol and may also bear the letters "PETE" or "PET." The color is usually transparent green or clear. A PET container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent. Examples include beverage containers such as single-serve water bottles, juice bottles, and soft drink bottles less than 68 ounces.

9. **Non-HI-5 Plastic PET Containers**: PET (polyethylene terephthalate) clear or colored PET containers that do not display the HI-5 notification. When marked for identification, it bears the number "1" in the center of the triangular recycling symbol and may also bear the letters "PETE" or "PET." The color is usually transparent green or clear. A PET container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent. Examples include juice or water bottles that are larger than 68 ounces, wine and liquor bottles, food jars, pastry jars, frozen food or other trays, clamshell packaging, and aspirin bottles. HI-5 plastic PET containers that are broken, missing pieces (excluding the cap), and/or without the label or part of the label that contains the HI-5 insignia are included in this type.

10. **HI-5 Plastic HDPE Containers**: HDPE (high-density polyethylene) natural and colored containers that display the HI-5 notification and are unbroken. This plastic is usually either cloudy white, allowing light to pass through it (natural), or a solid color, preventing light from passing through it (colored). When marked for identification, it bears the number “2” in the triangular recycling symbol and may also bear the letters “HDPE.” Examples include water jugs and some small juice bottles less than 68 ounces.

11. **Non-HI-5 Plastic HDPE Containers**: HDPE (high-density polyethylene) natural and colored HDPE containers that do not display the HI-5 notification. This plastic is usually either cloudy white, allowing light to pass through it (natural), or a solid color, preventing light from passing through it (colored). When marked for identification, it bears the number "2" in the triangular recycling symbol and may also bear the letters "HDPE." Examples include water jugs larger than 68 ounces, milk jugs, detergent bottles, some hair-care bottles, some margarine and yogurt tubs, clamshell packaging, empty motor oil, empty antifreeze, and other empty vehicle and equipment fluid containers. HI-5 plastic HDPE containers that are broken, missing pieces (excluding the cap), and/or without the label or part of the label that contains the HI-5 insignia are included in this type.

12. **Other Bottles/Containers**: Plastic bottles or containers that do not display the HI-5 notification that are made of types of plastic other than HDPE or PET. Items may be made of PVC, PP, or PS. When marked for identification, these items may bear the number "3," "4," "5," "6," or "7" in the triangular recycling symbol. This subtype also includes plastic containers that do not have the triangular recycling symbol. Examples include hardware and fastener packaging, food containers such as bottles for salad dressings and vegetable oils, flexible and brittle yogurt cups, syrup bottles, margarine tubs, microwave food trays, and clamshell-shaped fast food containers. This type also includes some shampoo containers, vitamin bottles, and clamshell-like muffin containers. This type excludes Styrofoam and expanded polystyrene products.

13. **Mixed Rigid/Durable Plastics:** All other non-bottle/container plastic materials that hold a shape. These items are made to last for more than one use. Examples include: crates, buckets (including 5-gallon buckets), baskets, and totes. This type also includes building materials such as house siding, window sashes and frames, housings for electronics such as computers, televisions and stereos, fan blades, and plastic pipes and fittings.

14. **Plastic Bags**: Labeled grocery, merchandise, dry cleaner, and newspaper polyethylene film bags that were not contaminated with food, liquid, or grit during use. This type excludes garbage bags, produce bags, and Ziploc bags.

15. **Other Plastic Film/Wrap:** Film packaging and products, excluding plastic bag types described above. Included in this type are shrink wrap, film bubble wrap, garbage bags, produce bags, and Ziploc bags. Also included in this material type are agricultural film plastics used in farming and growing applications and clean plastic film used for large-scale packaging or transport packaging.

16. **Expanded Polystyrene**: Materials made of expanded polystyrene (EPS) or Styrofoam. Examples include EPS drinking cups, plates, meat trays, packing blocks, and foam packing peanuts.

17. **Other Plastic:** Plastic that cannot be put in any other type. This type includes items made mostly of plastic but combined with other materials. Examples include auto parts made of plastic attached to metal, plastic drinking straws, cookie trays found in cookie packages, plastic strapping, plastic lids, some kitchen ware, some toys, window blinds, plastic lumber, insulating foam, imitation ceramics, handles and knobs, plastic string (such as that used for hay bales), plastic rigid bubble/foil packaging (as for medications), small (less than 1 gallon) plant containers such as nursery pots and plant six-packs, and new Formica, new vinyl, or new linoleum.

METAL

18. **HI-5 Aluminum Containers:** Any beverage container that is made mainly of aluminum and that displays the HI-5 notification and is unbroken. Examples include containers for soda, water, juice, coffee, tea, beer, mixed wine, or mixed spirit. Dairy containers do not pay a deposit and are not included in this material type.

19. **Non-HI-5 Aluminum Containers and Aluminum Scrap:** Any food or beverage container that is made mainly of aluminum and that does not display the HI-5 notification. Examples include some pet food and meat (e.g., Spam and Vienna sausage) cans, and cans that have contained dairy. Scrap aluminum, including clean aluminum foil, is also included in this type. HI-5 aluminum containers that are broken, missing pieces (excluding the cap), and/or without the label or part of the label that contains the HI-5 insignia are included in this type.

20. **HI-5 Bi-metal Containers:** Rigid, unbroken beverage containers made from metals and containing the HI-5 logo. Examples include containers for soda, water, juice (coconut water), coffee, tea, beer, mixed wine, or mixed spirit. Dairy containers do not pay a deposit and are not included in this material type.

21. **Tin/Steel Containers**. Rigid containers made mainly of steel. These items will stick to a magnet and may be tin-coated. These are used to store food, beverages, paint, and a variety of other household and consumer products. Examples include canned food and beverage containers, and bimetal containers (without the HI-5 label) with steel sides and aluminum ends.

22. **Other Ferrous Metals**: All other materials composed of ferrous and alloyed ferrous scrap. This type does not include tin/steel cans. Examples include structural steel beams, metal clothes hangers, metal pipes, stainless steel cookware, security bars, used oil filters, empty metal paint cans, and scrap ferrous items.

23. **Other Non-Ferrous Metals**: All other materials composed of metals not derived from iron, including copper, brass, bronze, aluminum bronze, lead, pewter, zinc, and other metals to which a magnet will not adhere. Examples include aluminum window frames, aluminum siding, copper wire, shell casings, brass pipe, and aluminum foil.

24. **Other Metals**: Metal that cannot be put in any other type, such as materials that are composed both of ferrous and nonferrous metals and/or have contaminants (such as wood or plastic) attached. Examples include motors, insulated wire, and finished products that contain a mixture of metals, or metals and other materials, whose weight is derived significantly from the metal portion of its construction. This type also includes small appliances and tools.

GLASS

25. **HI-5 Glass Containers**: Whole clear or colored glass containers that display the HI-5 notification on the label. Examples include whole soda bottles and fruit juice bottles, and whole beer, wine cooler (mixed wine), and mixed spirit bottles. Wine and liquor bottles are not included. Broken Hi-5 glass containers are categorized as Contaminants (see below).

26. **Non-HI-5 Glass Containers**: Clear or colored glass containers that do not display the HI-5 notification on the label. Containers in this type can be whole or broken non-HI-5. Examples include wine and liquor bottles, mayonnaise jars, and jam jars.

27. **Other Glass**: All other non-container glass, such as light bulbs, window glass, mirrors, and glassware.

ORGANICS

28. **Food Waste—Vegetative:** Whole fruits and vegetables or scraps. Examples include loose vegetables or fruits, tree fruit, peelings, opened tea bags, and coffee grounds. This type also includes packaged fruits and vegetables, such as packaged salad, frozen vegetables, and other fruit or vegetable products in their original packaging or container from the point of sale.

29. **Food Waste—Non-Vegetative**: All other food items not already defined above. Examples include bread, meats, dairy, eggs, nuts, rice, and prepared foods that are a combination of food types.

30. **Green Waste**: Plant material including leaves, grass clippings, plants, seaweed, prunings, shrubs, branches, and stumps (less than 4 inches in diameter).

31. **Stumps**: Woody plant material, branches, and stumps that exceed 4 inches in diameter.

32. **Textiles**: Fabric materials, including natural and synthetic textiles such as cotton, wood, silk, woven nylon, rayon, polyester, and other materials. This type does not include cloth-covered furniture, mattresses, leather shoes, leather bags, or leather belts.

33. **Carpet**: Flooring applications consisting of various natural or synthetic fibers bonded to a backing material. This type does not include carpet padding or woven rugs with no backing.

34. **Other Organics**: All other organics (non-lumber) that do not fit into any of the above types, such as animal feces, animal bedding, fur, hair, and leather bags or leather belts.

INERTS AND C&D MATERIALS

35. **Untreated Wood**: Unpainted new or demolition dimensional lumber, engineered wood, or pallets/crates. This includes materials such as 2 x 4s, 2 x 6s, 2 x 12s, plywood, particleboard, wafer board, oriented strand board, wood pallets, crates, and packaging made of lumber/engineered wood, and residual materials from framing and related construction activities. May contain nails or other trace contaminants. Does not include wood pallets or crates.

36. **Treated Wood**: Lumber and wood products which have been painted (including stained lumber) or treated. Treated wood is typically identified by "staple marks" by which chemical was injected into the wood, a characteristic green color, and/or presence of obvious crystals.

37. **Pallets**: Wood pallets and crates.

38. **Gypsum Wallboard**: Interior wall covering made of a sheet of gypsum sandwiched between paper layers. Includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard. This type includes new and demolition gypsum wallboard.

39. **Asphalt Roofing**: Composite shingles and other roofing material made with asphalt. Examples include asphalt shingles and attached roofing tar and tar paper.

40. **Asphalt Paving**: A black or brown tar-like material mixed with aggregate used as a paving material.

41. **Concrete**: Portland cement mixtures (set or unset). Examples include pieces of building foundations, concrete paving, and concrete/cinder blocks. This category includes concrete with a steel internal structure composed of reinforcing bars (re-bar) or metal mesh.

42. **Ceramics**: Finished ceramic or porcelain products, such as tile, sinks, toilets, dishes, and planters.

43. **Sand/Soil/Rock/Dirt**: Sand, soil, rock, and dirt and mixed unidentifiable fines.

44. **Other C&D material**: Inerts and other material that cannot be put in any other type or items made up of a combination of different material types that are difficult to separate. Examples include brick, dried paint not attached to other materials, and fiberglass insulation. This type may also include demolition debris that is a mixture of items such as plate glass, wood, tiles, gypsum board, synthetic counter tops, fiber or composite acoustic ceiling tiles, and aluminum scrap.

HOUSEHOLD HAZARDOUS MATERIALS

45. **Pesticides/Herbicides**: Containers with a measurable amount of chemical pesticides or herbicides that are potentially harmful to the environment. These materials may cause handling problems or other hazards if improperly disposed of in the waste stream.

46. **Paints/Adhesives/Solvents**: Containers with a measurable amount of liquid paint, adhesives, or other solvents. This does not include dried paint, empty paint cans, or empty aerosol containers.

47. **Household Cleaners**: Containers with a measurable amount of liquid cleaner, disinfectant, or other chemical materials that may be harmful to the environment or pose other hazards if improperly disposed of in the waste stream.

48. **Other Automotive Products**: Containers with a measurable amount of vehicle or equipment fluid that may be harmful to the environment or cause other hazards if improperly disposed of in the waste stream. Examples include antifreeze, brake fluid, and used oil filters.

49. **Batteries**: Any type of battery. Includes dry cell, rechargeable, and lead-acid batteries. Examples include car, flashlight, small appliance, watch, and hearing aid batteries.

50. **Other HHW**: Other HHW materials not classified within any of the above categories which may be harmful to the environment or pose other hazards if improperly disposed of in the waste stream. Examples include medicines, fluorescent light bulbs, and medical waste such as sharps.

OTHER MATERIALS

51. **Sewage Sludge**: Sewage sludge material generated by wastewater treatment plants.

52. **Sewage Screenings/Grit**: Screenings and grit material generated by wastewater treatment plants.

53. **Industrial Sludges**: Sludge material generated by non-wastewater treatment plants.

54. **Tires**: Vehicle tires of all types. Tires may be pneumatic or solid. Examples include tires from trucks, automobiles, motorcycles, heavy equipment, lawn mowers, and bicycles.

55. **Furniture**: Furniture (composed of any material) and mattresses.

56. **Appliances**: Large appliances such as refrigerators, washing machines and dryers, hot water heaters, and stoves. This type does not include electronics such as televisions and stereos.

57. **Covered Electronic Devices:** Electronics covered under the State of Hawai'i Electronic Waste and Television Recycling and Recovery Law which requires manufacturer responsibility for recycling specified items**.** Electronic devices covered under this law include all computers, computer printers, computer monitors, and portable computers with screen size greater than four inches measured diagonally. Televisions covered under this law include devices that are capable of receiving broadcast, cable, or satellite signals and displaying television or video programming. This includes, without limitation, any direct view or projection televisions with viewable screen sizes of nine inches or larger with display technology based on cathode ray tube, plasma, liquid crystal on silicon, silicon crystal reflective display, light emitting diode, or similar technology.[3]

58. **Non-Covered Electronic Devices:** Electronics that are not covered under the State of Hawai'i Electronic Waste and Television Recycling and Recovery Law. Electronics in this category include personal digital assistants (PDAs), cell phones, phone systems, phone answering machines, computer games and other electronic toys, portable CD players, camcorders, digital cameras, cell phone chargers and other electronic device chargers, and other electronic devices. Other examples include stereos, VCRs, DVD players, large radios, keyboards, and mice. This type does not include corded small appliances such as toasters, microwaves, and power tools.

59. **Auto fluff**: Fine mixed waste material (less than 1 inch in diameter) generated by the process of pulverizing automobiles including wire, foam, mixed metal, etc. Also referred to as auto shredder residue.

60. **Mixed Residues**: Material that cannot be put in any other type. This includes material such as ash, kitty litter, and mixed residue that cannot be further sorted. This material type also includes "fines," materials from any other material category that are less than 2 inches in diameter.

[3] http://health.hawaii.gov/ewaste/files/2013/06/339D-2016.pdf

Appendix B: Study Design

Study Objective

The objective of the 2017 Oahu Waste Composition Study is to provide composition data for all municipal solid waste disposed of on the island of Oahu. The study includes waste composition analyses for four generating sectors—residential, commercial, residential self-haul, and commercial self-haul—across eight residential collection districts. This study is an update of two previous studies completed in 2006 and 2011.

This document outlines the proposed sampling methodology for this study and is organized into the following sections:

- Methodology
- Sampling Universe
- Sampling Calendar and Sampling Allocations
- Sample Collection and Sorting

Methodology

SAMPLING UNIVERSE

The sampling universe for this study included the following waste-generating sectors:

- **City-collected Residential**—waste generated by residents throughout Oahu and collected by City and County-operated collection vehicles. This study included material generated at both single-family and multifamily properties, including bulky items set out for collection. For the purposes of this study, this generating sector included the following types of waste:
    - **Gray cart waste by collection district:** Oahu is composed of seven collection districts (districts): Honolulu, Kapaa, Laie, Pearl City, Wahiawa, Waialua, and Waianae. Residents set out this waste in gray carts.
    - **Other waste types by collection method:** The study included samples from front loaders, which collect primarily multifamily material from 3-cubic-yard bins, and samples from rear loaders collecting bulky item set-outs. It also included samples from rear loader manual routes.
- **Residential self-haul**—waste from residential sources that is delivered to transfer stations, convenience centers, and the landfill by the resident/homeowner.

- **Privately-hauled Commercial**—waste primarily from institutional, commercial, or industrial sources and large multifamily properties that is collected by privately operated collection service providers and delivered primarily to H-power and sometimes to transfer stations and the landfill.
- **Commercial self-haul**—waste from commercial sources that is usually delivered by the actual generator and delivered primarily to H-power, and sometimes to transfer stations and the landfill.

SAMPLING CALENDAR AND SAMPLING ALLOCATIONS

Cascadia conducted the characterization study over a period of three weeks. Sampling took place between July 27 and August 15, 2017.[4] Of the 320 planned samples, our field crew sampled and sorted a total of 312 samples over the scheduled study period. Sampling took place primarily at four sampling sites: H-POWER, Waimanalo Gulch Landfill, Keehi Transfer Station, and Kapaa Transfer Station.[5] The number of planned vs. actual samples by generating sector and collection district/route type (as applicable) is shown in Table B-1 below.

[4] Nineteen of the bulky load samples were characterized in September and October by City staff due to a shortage of these loads during the sampling event.
[5] Samples from Laie and Waialua were captured at the City's Kawailoa Transfer Station and transferred to one of the sampling sites for sorting.

Table B-1. Planned vs. Actual Samples by Sector and Collection District or Route Type

Sector	Subsector (collection district or route type)	Planned Samples		Actual
		Visual	Hand-sort	
Residential	Honolulu		20	21
	Kapaa		20	21
	Laie		15	15
	Pearl City		20	20
	Wahiawa		15	16
	Waialua		15	14
	Waianae		15	15
	3-cubic-yard bins (mostly multifamily)		20	20
	Bulky collection	40		41
	Manual		20	21
Residential Self-haul		20*	20	20/20
Commercial			40	40
Commercial Self-haul		40		28
TOTAL		**100**	**220**	**312**

**Residential self-haul loads from convenience centers were visually characterized, while other residential self-haul loads were hand-sorted.*

SAMPLE COLLECTION AND SORTING

This section describes Cascadia's approach to obtaining and sorting samples for the 2017 Oahu Waste Composition Study.

Selection of Loads

Residential Gray Cart Routes

The City provided a complete list of gray cart routes from each district. Cascadia randomly selected routes for sampling from this list so that the number of routes selected matched the daily sampling targets by district (See Table B-1). See the *Vehicle Selection Sheet* in Appendix E: Sample Field Forms for an example of a daily list of selected routes.

Prior to the start of the study, Cascadia provided the collection yard supervisors a list of pre-selected residential gray cart routes as well as brightly colored *Sample Placards* (see Appendix E: Sample Field Forms). The collection yard supervisors handed out the *Sample Placards* to drivers of selected routes at the start of each sampling day. The drivers displayed the placards on the

dashboards of their trucks. The placard was used to alert scalehouse personnel and the field crew supervisor that the vehicle had been designated for participation in the study. When the pre-selected vehicle arrived at the disposal facility (transfer station, H-POWER, or the landfill), scalehouse personnel alerted the field crew supervisor, who then directed the driver of the load to tip adjacent to the sorting area. The collection yard supervisor communicated any changes to the routes selected for sampling to the field crew manager to ensure that sample selection occurred as planned at the disposal facility.

Commercial and Self-haul Wastes

Commercial and self-haul (both residential and commercial) loads were randomly selected for sampling using a systematic selection protocol. The systematic selection method ensured that the mix of sampled vehicles was representative of the commercial and self-haul loads delivered to the disposal facility.

To conduct systematic selection of vehicles, Cascadia used the following process:

1. Cascadia first obtained relevant historical data from the City on the total number of loads arriving at each facility.
2. Cascadia established a "sampling frequency" based on the estimated number of loads (based on historical data), which was calculated by dividing the total expected number of loads for each sector included in the study by the target number of samples. The sampling frequency determined which vehicles must be sampled—such as every third vehicle, every sixth vehicle, or every 20th vehicle. The *Vehicle Selection Forms* were used to clearly communicate the sampling frequency required for each day of the study at each site (see Appendix E: Sample Field Forms).
3. Scalehouse staff intercepted every *n*th vehicle arriving at the disposal facility based on the interval set out by the sampling frequency. The scalehouse attendant then interviewed the driver to obtain key information, including the generating sector. The attendant then affixed a *Sample Placard* on the vehicle's dashboard to indicate that it had been selected for sampling and directed the vehicle to the sorting area.

Cascadia trained scalehouse personnel on the vehicle selection strategy. The scalehouse attendants at each site selected vehicles for sampling, with instructional support from Cascadia staff as needed.

Characterizing Samples

Cascadia either hand-sorted or visually characterized samples, depending on the sector and collection district or route type, into the material types defined for the study. Residential bulky collection loads, commercial self-haul loads, and residential self-haul loads from convenience centers were visually characterized while all other samples were hand-sorted. See Appendix A: Material Category Definitions for the complete list of material types and definitions. The procedure for hand-sorting and visually sampling is described below.

Throughout the study, the field crew manager oversaw sample sorting activities to ensure that sorters followed the sorting protocol and all health and safety requirements and understood and uniformly interpreted the material categories.

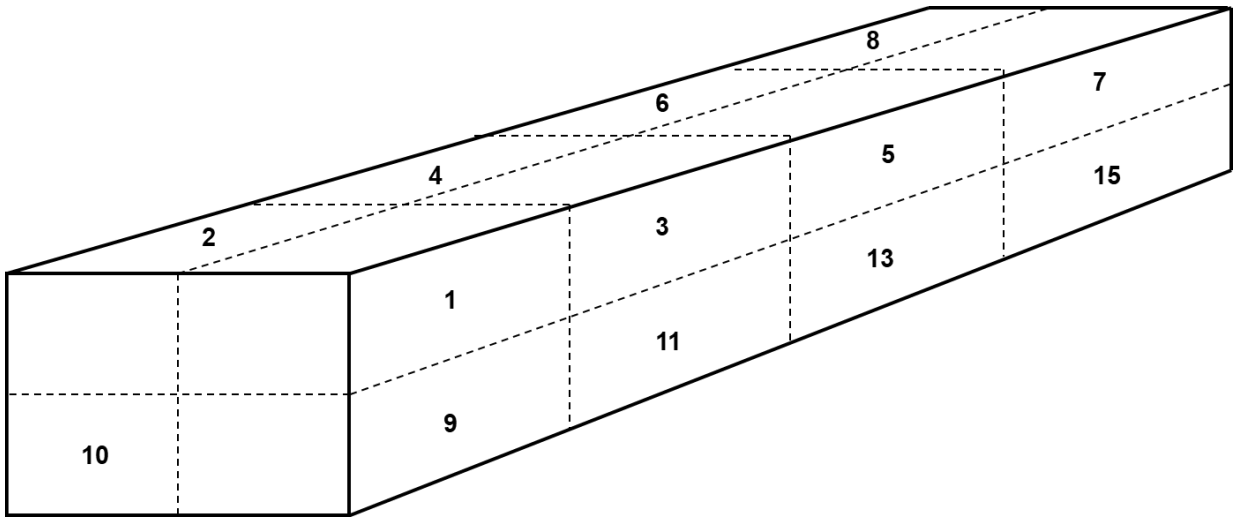
Hand-sort Procedure

Selection of Samples

Figure B-2: Tarped Sampled with Sample Placard

Selected loads from residential and commercial routes were tipped in an elongated pile. From each load, a sample was selected using an imaginary 16-cell grid (as shown in Figure B-1) superimposed over the tipped material.

Figure B-1: 16-Cell Grid for Sampling



A member of the field crew identified the randomly selected cell grid from which a sample would be collected. Working with facility staff, the field crew manager ensured that a sample of garbage weighing 200 to 250 pounds was obtained from the selected cell and transported to the characterization area. Samples were collected before facility staff diverted any materials from the load. Each sample was placed on a clean tarp with the *Sample Placard*, which identified and provided key information (such as generator and vehicle type) about the sample.

Cascadia's process for hand-sorting waste included the following steps:

1. A member of the field crew took photographs of the sample using a digital camera. The *Sample Placard* identifying the sample was positioned to be visible in each photo. Figure B-2 shows a sample ready to be sorted on a tarp with a placard.
2. The field crew sorted the sample into the material types and stored separated materials in plastic laundry baskets. Individual members of the sorting crew typically specialize in groups of materials, such as papers or plastics. The field crew manager monitored the homogeneity of material in the baskets as they accumulated, rejecting any materials that were improperly classified. The material list and definitions that guided this sorting are presented in Appendix A: Material Category Definitions.
3. The field crew manager then visually inspected the purity of each material as it was weighed in its basket using a pre-calibrated scale and recorded each material weight on the *Material Weight Tally Sheet*. See Appendix E: Sample Field Forms for example field forms.

Visual Sampling Procedure

Cascadia's process for visually characterizing waste included the following steps:

1. A member of the field crew took photographs of the sample using a digital camera. The *Sample Placard* identifying the sample was positioned to be visible in each photo.
2. A member of the field crew used a tape measure to obtain the length, width, and height of the sample and recorded the total volume on the *Visual Characterization Form* (see Appendix E: Sample Field Forms).
3. The field crew member walked around the entire load and wrote down the major material classes that were present in the load on the *Visual Characterization Form*.
4. Beginning with the largest major material class present by volume, the crewmember estimated the volume percentage of each material class (e.g., paper or glass) and recorded it on the *Visual Characterization Form*. This process was repeated for the next most common material class, and so forth, until the volume percentage of every material class had been

estimated. The crewmember then calculated the sum for this step, ensuring that it totaled 100 percent.

5. Next, the crewmember considered each material class separately and estimated the percentage of each material class that was made up of each material component. For example, newspaper may be a material component within the material class of paper. While considering only the paper material class, the crewmember would estimate the volume percentage of paper materials that was composed of newspaper. The crewmember would then do the same for every other material component within the paper material class (such as cardboard). The total of percentages for all of the material components had to equal 100 percent.
6. The crewmember ensured that the percentage estimates for the major material classes added up to 100 percent. The percentage estimates for the specific material components within each major class also had to total 100 percent.

Clean-up

The field crew ensured that the workspace was left in good condition and took steps to reduce or eliminate the risk of litter. A thorough clean-up effort followed each day of work and included the following:

- Organizing and stowing sorting supplies in a designated location.
- Storing all sorted material throughout the day in the area or container designated by facility staff.
- Sweeping and cleaning the sort area to prevent windblown litter.
- Removing and properly disposing of any single-use personal protective equipment.
- Checking out with the facility manager each day.

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Appendix C: Refuse Division Detailed Results

Overall Gray Cart Waste

Figure C-1: Overview of Waste: Gray Cart Waste, Overall, 2017

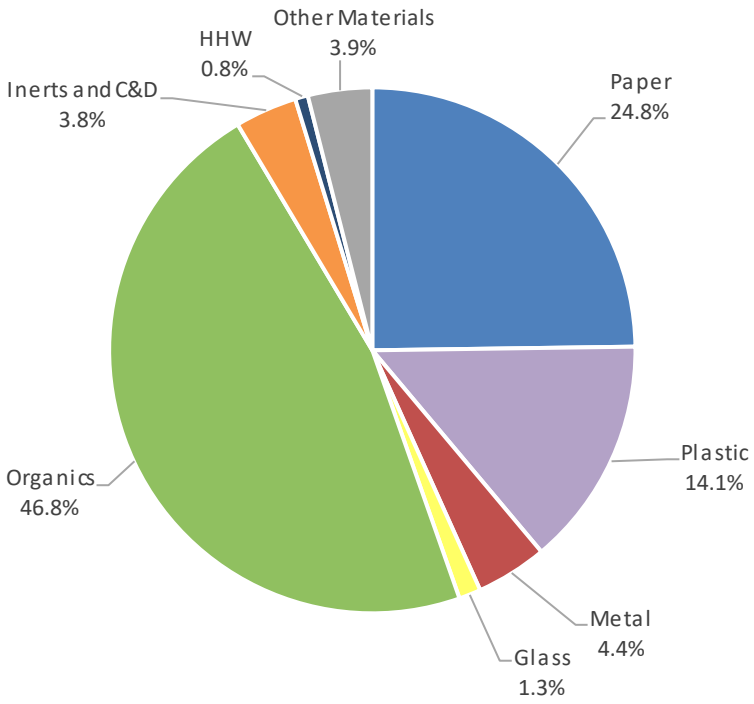

Table C-1: Ten Most Prevalent Material Categories in Overall Gray Cart Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	14.7%	14.7%	27,242
Food Waste-Vegetative	10.2%	24.9%	19,043
Other Organics	9.7%	34.6%	17,968
Compostable Paper	8.9%	43.5%	16,567
Mixed Recyclable Paper	8.5%	52.0%	15,803
Green Waste	7.5%	59.5%	13,947
Other Plastic Film/Wrap	6.5%	66.0%	12,028
Textiles	4.4%	70.4%	8,121
Mixed Residues	3.2%	73.5%	5,896
Uncoated Corrugated Cardboard	2.6%	76.1%	4,844
Subtotal	***76.1%***		***141,458***
All other materials	23.9%		44,337
Total	**100.0%**		**185,795**

Table C-2: Detailed Waste Composition: Gray Carts, Overall

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**24.8%**		**46,036**	**Glass**	**1.3%**		**2,508**
Uncoated Corrugated Cardboard	2.6%	0.3%	4,844	HI-5 Glass Containers	0.5%	0.1%	882
Newspaper	1.6%	0.2%	2,967	Non-HI-5 Glass Containers	0.7%	0.1%	1,348
Paper Bags	1.3%	0.1%	2,391	Other Glass	0.1%	0.1%	278
White and Colored Ledger Paper	0.8%	0.3%	1,429				
Mixed Recyclable Paper	8.5%	0.8%	15,803	**Inerts and C&D Materials**	**3.8%**		**7,093**
Compostable Paper	8.9%	0.7%	16,567	Untreated Wood	0.3%	0.2%	497
Other Paper	1.1%	0.3%	2,036	Treated Wood	1.2%	0.4%	2,202
				Pallets	0.1%	0.1%	103
Plastic	**14.1%**		**26,222**	Gypsum Wallboard	0.1%	0.1%	137
HI-5 Plastic PET Containers	0.4%	0.1%	827	Asphalt Roofing	0.0%	0.0%	52
Non-HI-5 Plastic PET Containers	0.5%	0.1%	983	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	15	Concrete	0.1%	0.1%	237
Non-HI-5 Plastic HDPE Containers	0.9%	0.1%	1,722	Ceramics	0.1%	0.1%	244
Other Bottles/Containers	1.6%	0.1%	3,018	Sand/Soil/Rock/Dirt	0.1%	0.1%	208
Mixed Rigid/Durable Plastics	2.3%	0.3%	4,253	Other C&D Material	1.8%	1.2%	3,412
Plastic Bags	0.1%	0.0%	272				
Other Plastic Film/Wrap	6.5%	0.4%	12,028	**Household Hazardous Waste**	**0.8%**		**1,459**
Expanded Polystyrene	0.9%	0.1%	1,707	Pesticides/Herbicides	0.0%	0.0%	14
Other Plastic	0.8%	0.3%	1,396	Paints/Adhesives/Solvents	0.2%	0.2%	284
				Household Cleaners	0.0%	0.0%	39
Metal	**4.4%**		**8,149**	Other Automotive Products	0.3%	0.2%	482
HI-5 Aluminum Containers	0.3%	0.0%	480	Batteries	0.1%	0.0%	137
Non-HI-5 Aluminum Containers and Scrap	0.6%	0.1%	1,055	Other HHW	0.3%	0.1%	504
HI-5 Bi-metal Containers	0.0%	0.0%	87				
Tin/Steel Containers	0.9%	0.1%	1,586	**Other Materials**	**3.9%**		**7,332**
Other Ferrous Metals	0.9%	0.3%	1,744	Sewage Sludge	0.0%	0.0%	25
Other Non-Ferrous Metals	0.1%	0.1%	230	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.6%	0.4%	2,966	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	6
Organics	**46.8%**		**86,997**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	10.2%	1.0%	19,043	Appliances	0.3%	0.3%	606
Food Waste-Non-Vegetative	14.7%	1.3%	27,242	Covered Electronic Devices	0.3%	0.3%	599
Green Waste	7.5%	1.6%	13,947	Non-Covered Electronic Devices	0.1%	0.1%	184
Stumps	0.1%	0.1%	201	Auto Fluff	0.0%	0.0%	15
Textiles	4.4%	1.2%	8,121	Mixed Residues	3.2%	0.5%	5,896
Carpet	0.3%	0.2%	475				
Other Organics	9.7%	1.7%	17,968	**Totals**	**100.0%**		**185,795**
				Sample Count			**122**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Honolulu

Figure C-2: Overview of Waste: Gray Cart Waste, Honolulu, 2017

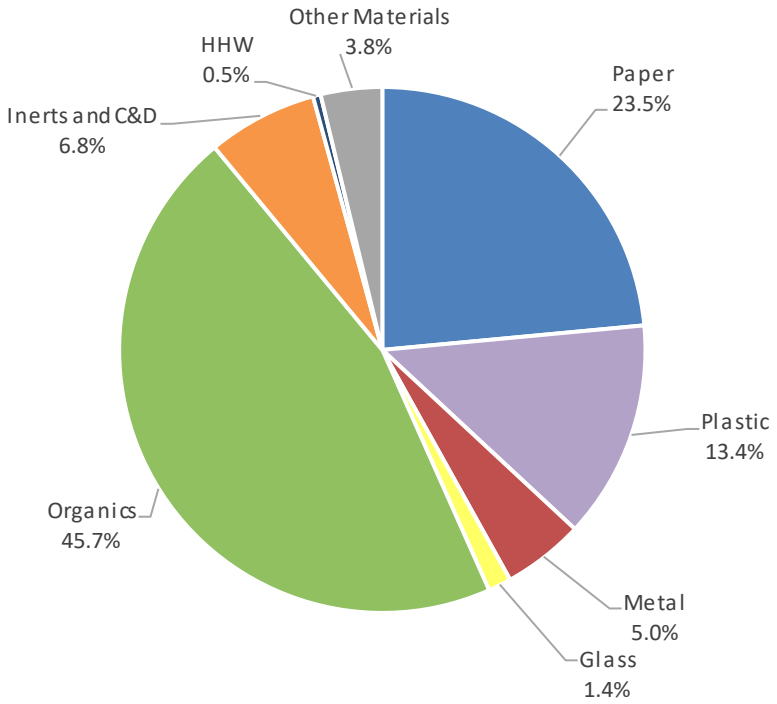

Table C-3: Ten Most Prevalent Material Categories in Honolulu Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	16.3%	16.3%	8,653
Food Waste-Vegetative	9.5%	25.8%	5,023
Mixed Recyclable Paper	9.0%	34.8%	4,778
Compostable Paper	7.2%	42.1%	3,833
Other Organics	7.1%	49.2%	3,777
Other Plastic Film/Wrap	6.6%	55.7%	3,475
Green Waste	6.4%	62.1%	3,387
Textiles	6.1%	68.3%	3,255
Other C&D Material	4.0%	72.3%	2,132
Mixed Residues	2.6%	74.9%	1,375
Subtotal	***74.9%***		***39,687***
All other materials	25.1%		13,308
Total	**100.0%**		**52,995**

Table C-4: Detailed Waste Composition: Gray Carts, Honolulu

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**23.5%**		**12,459**	**Glass**	**1.4%**		**751**
Uncoated Corrugated Cardboard	2.4%	0.7%	1,298	HI-5 Glass Containers	0.4%	0.2%	219
Newspaper	1.9%	0.5%	1,001	Non-HI-5 Glass Containers	0.9%	0.2%	472
Paper Bags	1.4%	0.2%	721	Other Glass	0.1%	0.1%	60
White and Colored Ledger Paper	0.3%	0.2%	180				
Mixed Recyclable Paper	9.0%	1.3%	4,778	**Inerts and C&D Materials**	**6.8%**		**3,580**
Compostable Paper	7.2%	0.7%	3,833	Untreated Wood	0.3%	0.4%	180
Other Paper	1.2%	0.4%	649	Treated Wood	1.6%	1.1%	832
				Pallets	0.0%	0.0%	0
Plastic	**13.4%**		**7,111**	Gypsum Wallboard	0.2%	0.4%	128
HI-5 Plastic PET Containers	0.3%	0.1%	146	Asphalt Roofing	0.0%	0.0%	3
Non-HI-5 Plastic PET Containers	0.4%	0.1%	234	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	1	Concrete	0.3%	0.3%	181
Non-HI-5 Plastic HDPE Containers	0.8%	0.2%	446	Ceramics	0.1%	0.1%	34
Other Bottles/Containers	1.7%	0.4%	908	Sand/Soil/Rock/Dirt	0.2%	0.2%	91
Mixed Rigid/Durable Plastics	2.1%	0.4%	1,109	Other C&D Material	4.0%	4.2%	2,132
Plastic Bags	0.1%	0.0%	54				
Other Plastic Film/Wrap	6.6%	0.7%	3,475	**Household Hazardous Waste**	**0.5%**		**251**
Expanded Polystyrene	0.8%	0.1%	429	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.6%	0.2%	309	Paints/Adhesives/Solvents	0.0%	0.0%	14
				Household Cleaners	0.0%	0.0%	0
Metal	**5.0%**		**2,651**	Other Automotive Products	0.0%	0.0%	9
HI-5 Aluminum Containers	0.1%	0.0%	63	Batteries	0.1%	0.1%	43
Non-HI-5 Aluminum Containers and Scrap	0.5%	0.1%	257	Other HHW	0.3%	0.3%	185
HI-5 Bi-metal Containers	0.0%	0.0%	11				
Tin/Steel Containers	0.9%	0.2%	457	**Other Materials**	**3.8%**		**1,999**
Other Ferrous Metals	0.9%	0.4%	460	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.1%	0.1%	38	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	2.6%	1.3%	1,365	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**45.7%**		**24,193**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	9.5%	1.7%	5,023	Appliances	0.4%	0.6%	194
Food Waste-Non-Vegetative	16.3%	3.3%	8,653	Covered Electronic Devices	0.7%	0.9%	372
Green Waste	6.4%	2.9%	3,387	Non-Covered Electronic Devices	0.1%	0.2%	59
Stumps	0.1%	0.2%	68	Auto Fluff	0.0%	0.0%	0
Textiles	6.1%	4.2%	3,255	Mixed Residues	2.6%	0.9%	1,375
Carpet	0.1%	0.1%	30				
Other Organics	7.1%	1.8%	3,777	**Totals**	**100.0%**		**52,995**
				Sample Count			**21**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Kapaa

Figure C-3: Overview of Waste: Gray Cart Waste, Kapaa, 2017

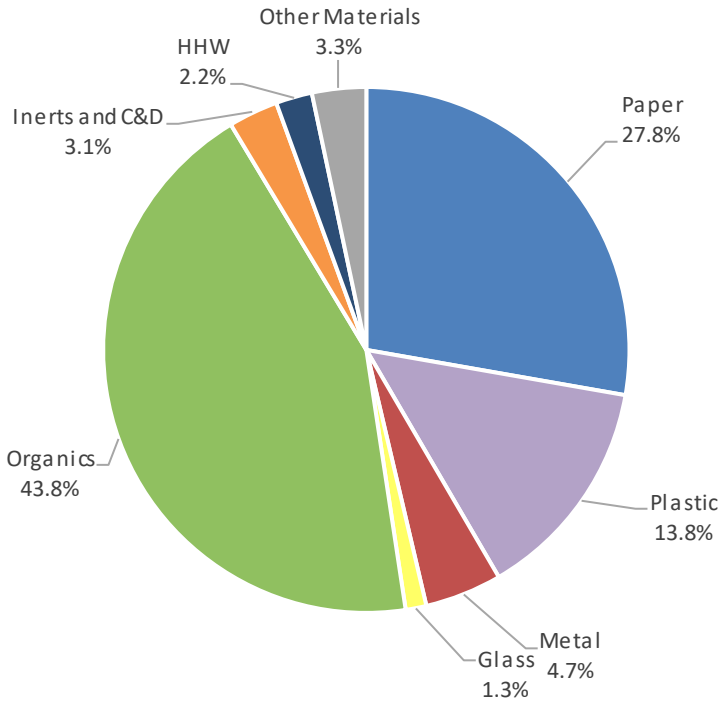

Table C-5: Ten Most Prevalent Material Categories in Kapaa Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	12.4%	12.4%	3,536
Mixed Recyclable Paper	11.5%	23.9%	3,264
Green Waste	10.4%	34.4%	2,969
Compostable Paper	9.5%	43.9%	2,710
Food Waste-Vegetative	9.1%	53.0%	2,585
Other Organics	7.2%	60.2%	2,049
Other Plastic Film/Wrap	6.0%	66.2%	1,716
Textiles	3.9%	70.2%	1,120
Mixed Residues	3.0%	73.2%	842
Uncoated Corrugated Cardboard	2.2%	75.3%	616
Subtotal	***75.3%***		***21,407***
All other materials	24.7%		7,014
Total	**100.0%**		**28,421**

Table C-6: Detailed Waste Composition: Gray Carts, Kapaa

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**27.8%**		**7,888**	**Glass**	**1.3%**		**362**
Uncoated Corrugated Cardboard	2.2%	0.4%	616	HI-5 Glass Containers	0.5%	0.2%	132
Newspaper	1.8%	0.4%	498	Non-HI-5 Glass Containers	0.6%	0.2%	169
Paper Bags	1.5%	0.3%	417	Other Glass	0.2%	0.1%	61
White and Colored Ledger Paper	0.7%	0.4%	193				
Mixed Recyclable Paper	11.5%	1.6%	3,264	**Inerts and C&D Materials**	**3.1%**		**867**
Compostable Paper	9.5%	1.1%	2,710	Untreated Wood	0.5%	0.6%	151
Other Paper	0.7%	0.2%	190	Treated Wood	0.9%	0.4%	265
				Pallets	0.0%	0.0%	0
Plastic	**13.8%**		**3,935**	Gypsum Wallboard	0.0%	0.0%	9
HI-5 Plastic PET Containers	0.5%	0.1%	134	Asphalt Roofing	0.0%	0.0%	5
Non-HI-5 Plastic PET Containers	0.4%	0.1%	110	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	0	Concrete	0.0%	0.0%	8
Non-HI-5 Plastic HDPE Containers	0.8%	0.2%	236	Ceramics	0.1%	0.0%	18
Other Bottles/Containers	1.8%	0.3%	525	Sand/Soil/Rock/Dirt	0.0%	0.0%	0
Mixed Rigid/Durable Plastics	2.2%	0.5%	614	Other C&D Material	1.4%	1.4%	412
Plastic Bags	0.1%	0.0%	17				
Other Plastic Film/Wrap	6.0%	0.6%	1,716	**Household Hazardous Waste**	**2.2%**		**635**
Expanded Polystyrene	0.9%	0.2%	269	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	1.1%	0.9%	315	Paints/Adhesives/Solvents	0.8%	1.2%	227
				Household Cleaners	0.0%	0.0%	0
Metal	**4.7%**		**1,345**	Other Automotive Products	1.2%	1.4%	339
HI-5 Aluminum Containers	0.3%	0.1%	84	Batteries	0.1%	0.1%	23
Non-HI-5 Aluminum Containers and Scrap	0.6%	0.1%	162	Other HHW	0.2%	0.1%	46
HI-5 Bi-metal Containers	0.1%	0.0%	14				
Tin/Steel Containers	1.0%	0.3%	274	**Other Materials**	**3.3%**		**945**
Other Ferrous Metals	1.4%	0.9%	396	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.1%	0.1%	17	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.4%	0.6%	400	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**43.8%**		**12,443**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	9.1%	1.6%	2,585	Appliances	0.2%	0.4%	70
Food Waste-Non-Vegetative	12.4%	2.0%	3,536	Covered Electronic Devices	0.0%	0.0%	3
Green Waste	10.4%	4.2%	2,969	Non-Covered Electronic Devices	0.1%	0.1%	30
Stumps	0.1%	0.2%	38	Auto Fluff	0.0%	0.0%	0
Textiles	3.9%	1.2%	1,120	Mixed Residues	3.0%	0.9%	842
Carpet	0.5%	0.9%	147				
Other Organics	7.2%	1.9%	2,049	**Totals**	**100.0%**		**28,421**
				Sample Count			**21**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Laie

Figure C-4: Overview of Waste: Gray Cart Waste, Laie, 2017

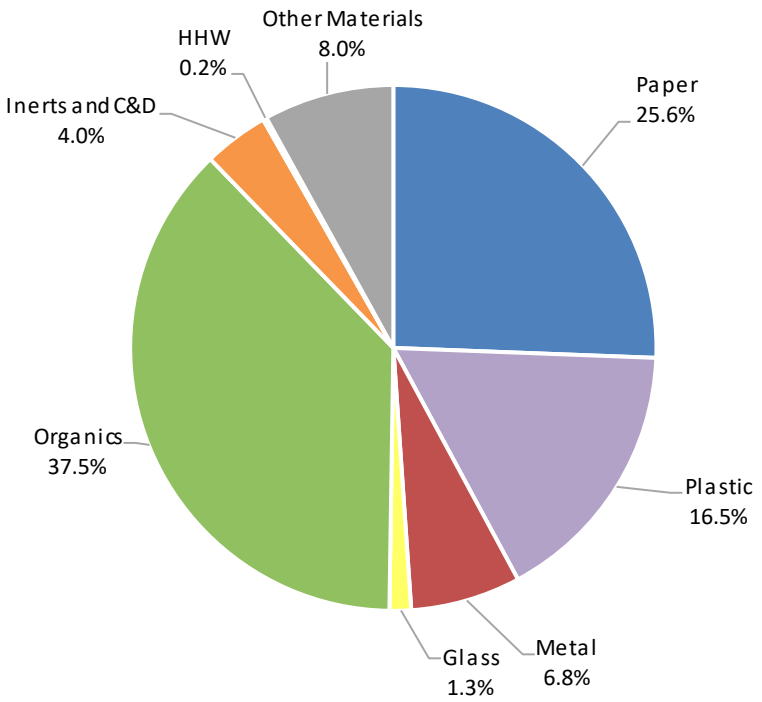

Table C-7: Ten Most Prevalent Material Categories in Laie Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	11.7%	11.7%	790
Compostable Paper	9.3%	21.0%	628
Mixed Recyclable Paper	8.6%	29.6%	580
Other Plastic Film/Wrap	8.2%	37.8%	552
Other Organics	7.2%	45.0%	487
Mixed Residues	7.2%	52.2%	484
Green Waste	7.1%	59.3%	476
Food Waste-Vegetative	6.1%	65.4%	413
Textiles	5.1%	70.5%	345
Uncoated Corrugated Cardboard	3.3%	73.8%	220
Subtotal	***73.8%***		***4,977***
All other materials	26.2%		1,769
Total	**100.0%**		**6,746**

Table C-8: Detailed Waste Composition: Gray Carts, Laie

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**25.6%**		**1,727**	**Glass**	**1.3%**		**90**
Uncoated Corrugated Cardboard	3.3%	0.6%	220	HI-5 Glass Containers	0.7%	0.3%	44
Newspaper	1.7%	0.5%	116	Non-HI-5 Glass Containers	0.5%	0.3%	34
Paper Bags	1.6%	0.2%	109	Other Glass	0.2%	0.1%	12
White and Colored Ledger Paper	0.2%	0.1%	14				
Mixed Recyclable Paper	8.6%	1.8%	580	**Inerts and C&D Materials**	**4.0%**		**270**
Compostable Paper	9.3%	1.4%	628	Untreated Wood	0.2%	0.3%	14
Other Paper	0.9%	0.5%	59	Treated Wood	0.6%	0.4%	41
				Pallets	0.0%	0.0%	0
Plastic	**16.5%**		**1,116**	Gypsum Wallboard	0.0%	0.0%	1
HI-5 Plastic PET Containers	0.8%	0.1%	54	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.6%	0.1%	38	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.1%	0.1%	4	Concrete	0.7%	0.6%	44
Non-HI-5 Plastic HDPE Containers	0.9%	0.2%	59	Ceramics	0.2%	0.2%	13
Other Bottles/Containers	1.6%	0.3%	105	Sand/Soil/Rock/Dirt	0.1%	0.1%	6
Mixed Rigid/Durable Plastics	2.3%	0.4%	153	Other C&D Material	2.2%	1.9%	151
Plastic Bags	0.0%	0.0%	3				
Other Plastic Film/Wrap	8.2%	0.8%	552	**Household Hazardous Waste**	**0.2%**		**15**
Expanded Polystyrene	1.0%	0.3%	67	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	1.2%	1.2%	82	Paints/Adhesives/Solvents	0.1%	0.1%	4
				Household Cleaners	0.0%	0.0%	0
Metal	**6.8%**		**457**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.5%	0.2%	33	Batteries	0.1%	0.1%	5
Non-HI-5 Aluminum Containers and Scrap	1.0%	0.3%	65	Other HHW	0.1%	0.1%	6
HI-5 Bi-metal Containers	0.0%	0.0%	2				
Tin/Steel Containers	1.1%	0.2%	76	**Other Materials**	**8.0%**		**541**
Other Ferrous Metals	2.3%	2.2%	152	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.0%	0.0%	1	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.9%	0.8%	127	Industrial Sludges	0.0%	0.0%	0
				Tires	0.1%	0.1%	6
Organics	**37.5%**		**2,531**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	6.1%	1.8%	413	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	11.7%	2.8%	790	Covered Electronic Devices	0.7%	1.2%	47
Green Waste	7.1%	3.4%	476	Non-Covered Electronic Devices	0.0%	0.0%	3
Stumps	0.1%	0.1%	9	Auto Fluff	0.0%	0.0%	0
Textiles	5.1%	2.2%	345	Mixed Residues	7.2%	3.3%	484
Carpet	0.2%	0.2%	10				
Other Organics	7.2%	1.5%	487	**Totals**	**100.0%**		**6,746**
				Sample Count			**15**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Pearl City

Figure C-5: Overview of Waste: Gray Cart Waste, Pearl City, 2017

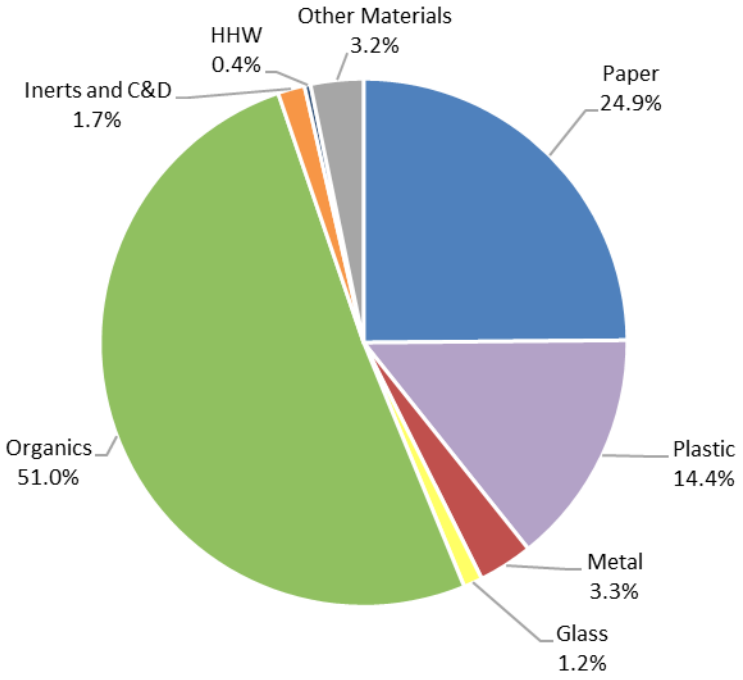

Table C-9: Ten Most Prevalent Material Categories in Pearl City Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	14.3%	14.3%	8,709
Other Organics	14.2%	28.5%	8,621
Food Waste-Vegetative	11.7%	40.2%	7,131
Compostable Paper	10.4%	50.6%	6,330
Green Waste	7.0%	57.6%	4,251
Mixed Recyclable Paper	6.7%	64.3%	4,065
Other Plastic Film/Wrap	6.4%	70.7%	3,871
Textiles	3.2%	73.9%	1,947
Uncoated Corrugated Cardboard	2.7%	76.6%	1,661
Mixed Rigid/Durable Plastics	2.6%	79.2%	1,589
Subtotal	***79.2%***		***48,175***
All other materials	20.8%		12,617
Total	**100.0%**		**60,792**

Table C-10: Detailed Waste Composition: Gray Carts, Pearl City

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**24.9%**		**15,108**	**Glass**	**1.2%**		**705**
Uncoated Corrugated Cardboard	2.7%	0.8%	1,661	HI-5 Glass Containers	0.4%	0.1%	227
Newspaper	1.5%	0.4%	925	Non-HI-5 Glass Containers	0.6%	0.2%	371
Paper Bags	1.1%	0.2%	674	Other Glass	0.2%	0.1%	107
White and Colored Ledger Paper	1.1%	0.8%	686				
Mixed Recyclable Paper	6.7%	1.9%	4,065	**Inerts and C&D Materials**	**1.7%**		**1,004**
Compostable Paper	10.4%	2.1%	6,330	Untreated Wood	0.1%	0.1%	41
Other Paper	1.3%	0.8%	767	Treated Wood	0.6%	0.5%	358
				Pallets	0.0%	0.0%	0
Plastic	**14.4%**		**8,766**	Gypsum Wallboard	0.0%	0.0%	0
HI-5 Plastic PET Containers	0.5%	0.1%	307	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.7%	0.2%	423	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	0	Concrete	0.0%	0.0%	0
Non-HI-5 Plastic HDPE Containers	1.2%	0.3%	700	Ceramics	0.2%	0.2%	108
Other Bottles/Containers	1.4%	0.2%	879	Sand/Soil/Rock/Dirt	0.1%	0.1%	67
Mixed Rigid/Durable Plastics	2.6%	0.9%	1,589	Other C&D Material	0.7%	0.7%	430
Plastic Bags	0.2%	0.0%	130				
Other Plastic Film/Wrap	6.4%	1.1%	3,871	**Household Hazardous Waste**	**0.4%**		**226**
Expanded Polystyrene	1.0%	0.2%	584	Pesticides/Herbicides	0.0%	0.0%	14
Other Plastic	0.5%	0.2%	284	Paints/Adhesives/Solvents	0.0%	0.1%	20
				Household Cleaners	0.1%	0.1%	38
Metal	**3.3%**		**2,029**	Other Automotive Products	0.0%	0.1%	30
HI-5 Aluminum Containers	0.3%	0.1%	179	Batteries	0.1%	0.1%	44
Non-HI-5 Aluminum Containers and Scrap	0.6%	0.1%	348	Other HHW	0.1%	0.1%	80
HI-5 Bi-metal Containers	0.1%	0.1%	49				
Tin/Steel Containers	0.7%	0.2%	410	**Other Materials**	**3.2%**		**1,970**
Other Ferrous Metals	0.5%	0.5%	325	Sewage Sludge	0.0%	0.1%	25
Other Non-Ferrous Metals	0.1%	0.1%	68	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.1%	0.6%	650	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**51.0%**		**30,983**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	11.7%	2.2%	7,131	Appliances	0.6%	0.9%	336
Food Waste-Non-Vegetative	14.3%	2.5%	8,709	Covered Electronic Devices	0.3%	0.3%	152
Green Waste	7.0%	3.5%	4,251	Non-Covered Electronic Devices	0.1%	0.1%	48
Stumps	0.1%	0.2%	65	Auto Fluff	0.0%	0.0%	0
Textiles	3.2%	0.8%	1,947	Mixed Residues	2.3%	0.8%	1,408
Carpet	0.4%	0.6%	259				
Other Organics	14.2%	4.8%	8,621	**Totals**	**100.0%**		**60,792**
				Sample Count			**20**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Wahiawa

Figure C-6: Overview of Waste: Gray Cart Waste, Wahiawa, 2017

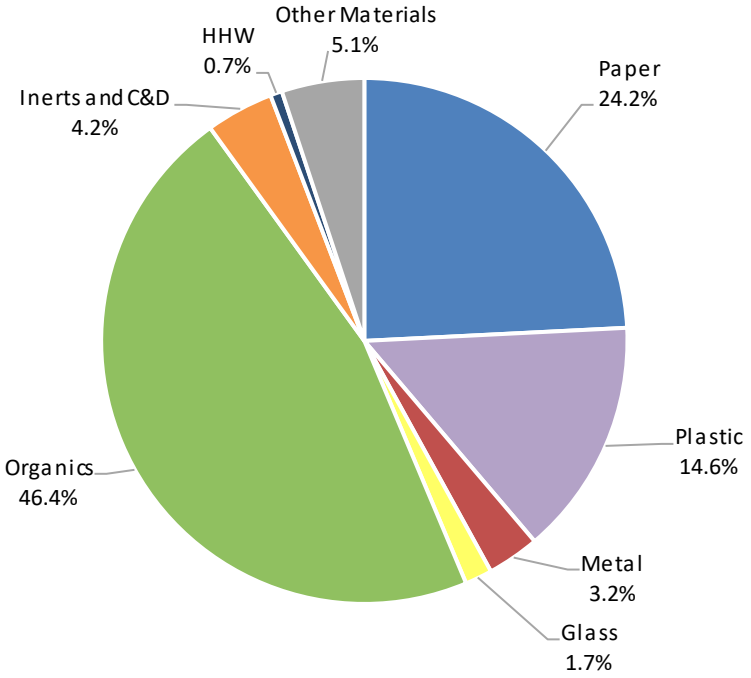

Table C-11: Ten Most Prevalent Material Categories in Wahiawa Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	15.7%	15.7%	2,786
Food Waste-Vegetative	11.8%	27.5%	2,085
Compostable Paper	9.3%	36.8%	1,643
Other Organics	8.5%	45.3%	1,512
Mixed Recyclable Paper	7.9%	53.2%	1,400
Green Waste	6.9%	60.1%	1,223
Other Plastic Film/Wrap	6.4%	66.5%	1,132
Mixed Residues	5.0%	71.5%	882
Textiles	3.2%	74.7%	572
Treated Wood	2.7%	77.4%	480
Subtotal	***77.4%***		***13,714***
All other materials	22.6%		3,996
Total	**100.0%**		**17,710**

Table C-12: Detailed Waste Composition: Gray Carts, Wahiawa

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**24.2%**		**4,286**	**Glass**	**1.7%**		**295**
Uncoated Corrugated Cardboard	2.2%	0.5%	396	HI-5 Glass Containers	0.7%	0.3%	128
Newspaper	0.8%	0.2%	137	Non-HI-5 Glass Containers	0.8%	0.4%	144
Paper Bags	1.2%	0.2%	219	Other Glass	0.1%	0.1%	23
White and Colored Ledger Paper	1.7%	1.1%	308				
Mixed Recyclable Paper	7.9%	1.6%	1,400	**Inerts and C&D Materials**	**4.2%**		**737**
Compostable Paper	9.3%	1.3%	1,643	Untreated Wood	0.0%	0.0%	0
Other Paper	1.0%	0.4%	183	Treated Wood	2.7%	2.1%	480
				Pallets	0.0%	0.0%	0
Plastic	**14.6%**		**2,584**	Gypsum Wallboard	0.0%	0.0%	0
HI-5 Plastic PET Containers	0.3%	0.1%	55	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.4%	0.1%	76	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	0	Concrete	0.0%	0.0%	0
Non-HI-5 Plastic HDPE Containers	0.8%	0.1%	142	Ceramics	0.3%	0.2%	45
Other Bottles/Containers	1.9%	0.3%	331	Sand/Soil/Rock/Dirt	0.0%	0.0%	0
Mixed Rigid/Durable Plastics	2.0%	0.5%	354	Other C&D Material	1.2%	1.8%	212
Plastic Bags	0.3%	0.2%	46				
Other Plastic Film/Wrap	6.4%	0.9%	1,132	**Household Hazardous Waste**	**0.7%**		**129**
Expanded Polystyrene	0.9%	0.2%	168	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	1.6%	2.0%	278	Paints/Adhesives/Solvents	0.1%	0.1%	11
				Household Cleaners	0.0%	0.0%	1
Metal	**3.2%**		**570**	Other Automotive Products	0.4%	0.7%	76
HI-5 Aluminum Containers	0.2%	0.0%	27	Batteries	0.0%	0.0%	7
Non-HI-5 Aluminum Containers and Scrap	0.3%	0.1%	61	Other HHW	0.2%	0.1%	34
HI-5 Bi-metal Containers	0.0%	0.0%	6				
Tin/Steel Containers	1.0%	0.2%	177	**Other Materials**	**5.1%**		**899**
Other Ferrous Metals	0.8%	0.4%	138	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.1%	0.1%	14	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	0.8%	0.4%	146	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**46.4%**		**8,210**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	11.8%	2.3%	2,085	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	15.7%	2.6%	2,786	Covered Electronic Devices	0.1%	0.1%	9
Green Waste	6.9%	2.8%	1,223	Non-Covered Electronic Devices	0.0%	0.1%	8
Stumps	0.0%	0.1%	8	Auto Fluff	0.0%	0.0%	0
Textiles	3.2%	1.1%	572	Mixed Residues	5.0%	1.8%	882
Carpet	0.1%	0.2%	25				
Other Organics	8.5%	1.6%	1,512	**Totals**	**100.0%**		**17,710**
				Sample Count			**16**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Waialua

Figure C-7: Overview of Waste: Gray Cart Waste, Waialua, 2017

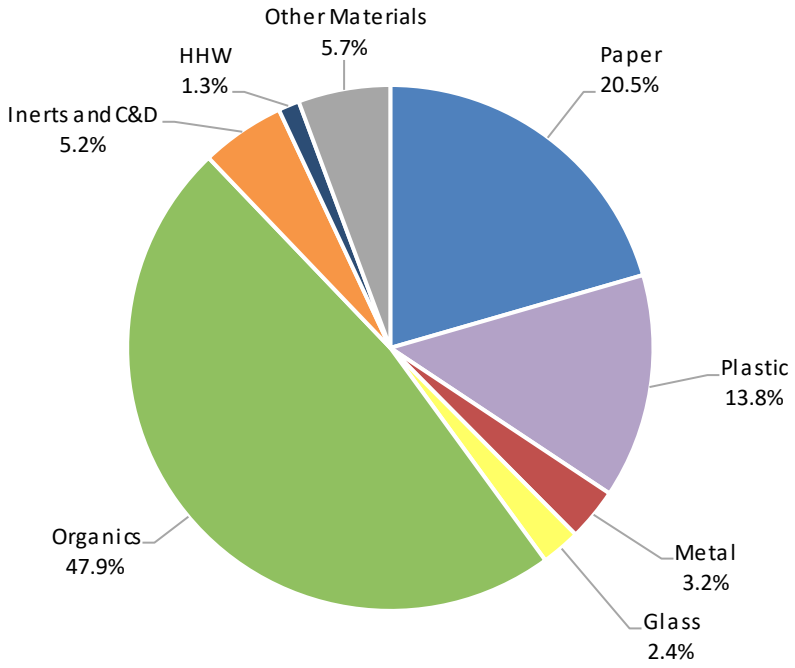

Table C-13: Ten Most Prevalent Material Categories in Waialua Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Green Waste	16.7%	16.7%	648
Food Waste-Vegetative	11.8%	28.5%	456
Food Waste-Non-Vegetative	9.9%	38.4%	384
Compostable Paper	7.5%	45.9%	290
Mixed Recyclable Paper	6.9%	52.7%	266
Other Plastic Film/Wrap	6.5%	59.2%	250
Mixed Residues	5.1%	64.3%	199
Textiles	4.8%	69.1%	186
Other Organics	4.6%	73.7%	177
Uncoated Corrugated Cardboard	3.6%	77.3%	141
Subtotal	***77.3%***		***2,996***
All other materials	22.7%		878
Total	**100.0%**		**3,874**

Table C-14: Detailed Waste Composition: Gray Carts, Waialua

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**20.5%**		**795**	**Glass**	**2.4%**		**93**
Uncoated Corrugated Cardboard	3.6%	1.4%	141	HI-5 Glass Containers	1.1%	0.5%	42
Newspaper	0.9%	0.3%	35	Non-HI-5 Glass Containers	1.2%	0.5%	48
Paper Bags	1.1%	0.2%	41	Other Glass	0.1%	0.1%	3
White and Colored Ledger Paper	0.2%	0.1%	6				
Mixed Recyclable Paper	6.9%	0.9%	266	**Inerts and C&D Materials**	**5.2%**		**200**
Compostable Paper	7.5%	1.2%	290	Untreated Wood	0.5%	0.5%	20
Other Paper	0.4%	0.1%	17	Treated Wood	0.8%	0.5%	31
				Pallets	0.0%	0.0%	0
Plastic	**13.8%**		**535**	Gypsum Wallboard	0.0%	0.0%	0
HI-5 Plastic PET Containers	0.6%	0.2%	23	Asphalt Roofing	1.1%	1.8%	44
Non-HI-5 Plastic PET Containers	0.5%	0.1%	18	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	0	Concrete	0.0%	0.0%	0
Non-HI-5 Plastic HDPE Containers	0.8%	0.2%	29	Ceramics	0.1%	0.1%	6
Other Bottles/Containers	1.7%	0.3%	65	Sand/Soil/Rock/Dirt	0.8%	1.3%	31
Mixed Rigid/Durable Plastics	1.7%	0.5%	66	Other C&D Material	1.8%	2.5%	69
Plastic Bags	0.1%	0.0%	3				
Other Plastic Film/Wrap	6.5%	0.5%	250	**Household Hazardous Waste**	**1.3%**		**50**
Expanded Polystyrene	0.7%	0.1%	29	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	1.3%	1.1%	50	Paints/Adhesives/Solvents	0.2%	0.3%	6
				Household Cleaners	0.0%	0.0%	0
Metal	**3.2%**		**125**	Other Automotive Products	0.7%	1.1%	28
HI-5 Aluminum Containers	0.4%	0.1%	17	Batteries	0.1%	0.1%	5
Non-HI-5 Aluminum Containers and Scrap	0.5%	0.1%	20	Other HHW	0.3%	0.2%	11
HI-5 Bi-metal Containers	0.0%	0.0%	2				
Tin/Steel Containers	0.8%	0.3%	32	**Other Materials**	**5.7%**		**219**
Other Ferrous Metals	0.6%	0.4%	23	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.0%	0.0%	0	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	0.8%	0.6%	31	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**47.9%**		**1,855**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	11.8%	2.2%	456	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	9.9%	1.0%	384	Covered Electronic Devices	0.0%	0.0%	0
Green Waste	16.7%	4.9%	648	Non-Covered Electronic Devices	0.5%	0.6%	20
Stumps	0.0%	0.0%	0	Auto Fluff	0.0%	0.0%	0
Textiles	4.8%	2.2%	186	Mixed Residues	5.1%	2.9%	199
Carpet	0.1%	0.2%	5				
Other Organics	4.6%	1.1%	177	**Totals**	**100.0%**		**3,874**
				Sample Count			**14**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Gray Cart Waste: Waianae

Figure C-8: Overview of Waste: Gray Cart Waste, Waianae, 2017

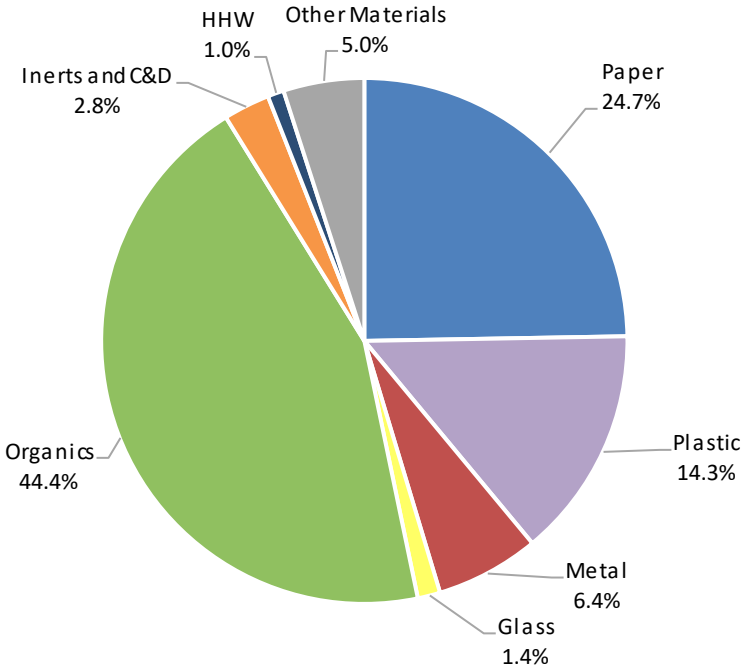

Table C-15: Ten Most Prevalent Material Categories in Waianae Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Food Waste-Non-Vegetative	15.6%	15.6%	2,384
Mixed Recyclable Paper	9.5%	25.1%	1,451
Food Waste-Vegetative	8.8%	34.0%	1,349
Other Organics	8.8%	42.8%	1,345
Compostable Paper	7.4%	50.2%	1,134
Other Plastic Film/Wrap	6.8%	57.0%	1,032
Green Waste	6.5%	63.5%	993
Mixed Residues	4.6%	68.1%	705
Textiles	4.6%	72.7%	696
Uncoated Corrugated Cardboard	3.4%	76.0%	512
Subtotal	***76.0%***		***11,601***
All other materials	24.0%		3,657
Total	**100.0%**		**15,258**

Table C-16: Detailed Waste Composition: Gray Carts, Waianae

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**24.7%**		**3,771**	**Glass**	**1.4%**		**211**
Uncoated Corrugated Cardboard	3.4%	1.2%	512	HI-5 Glass Containers	0.6%	0.4%	89
Newspaper	1.7%	0.7%	253	Non-HI-5 Glass Containers	0.7%	0.3%	110
Paper Bags	1.4%	0.3%	210	Other Glass	0.1%	0.1%	12
White and Colored Ledger Paper	0.3%	0.1%	42				
Mixed Recyclable Paper	9.5%	2.0%	1,451	**Inerts and C&D Materials**	**2.8%**		**435**
Compostable Paper	7.4%	1.1%	1,134	Untreated Wood	0.6%	0.8%	92
Other Paper	1.1%	0.5%	170	Treated Wood	1.3%	0.6%	195
				Pallets	0.7%	0.8%	103
Plastic	**14.3%**		**2,175**	Gypsum Wallboard	0.0%	0.0%	0
HI-5 Plastic PET Containers	0.7%	0.2%	108	Asphalt Roofing	0.0%	0.0%	1
Non-HI-5 Plastic PET Containers	0.5%	0.1%	82	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.1%	0.1%	10	Concrete	0.0%	0.0%	4
Non-HI-5 Plastic HDPE Containers	0.7%	0.1%	110	Ceramics	0.1%	0.2%	20
Other Bottles/Containers	1.3%	0.2%	205	Sand/Soil/Rock/Dirt	0.1%	0.1%	13
Mixed Rigid/Durable Plastics	2.4%	0.8%	367	Other C&D Material	0.0%	0.1%	6
Plastic Bags	0.1%	0.0%	19				
Other Plastic Film/Wrap	6.8%	0.7%	1,032	**Household Hazardous Waste**	**1.0%**		**153**
Expanded Polystyrene	1.1%	0.3%	162	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.5%	0.2%	79	Paints/Adhesives/Solvents	0.0%	0.0%	0
				Household Cleaners	0.0%	0.0%	0
Metal	**6.4%**		**973**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.5%	0.2%	77	Batteries	0.1%	0.0%	11
Non-HI-5 Aluminum Containers and Scrap	0.9%	0.2%	143	Other HHW	0.9%	1.1%	142
HI-5 Bi-metal Containers	0.0%	0.0%	3				
Tin/Steel Containers	1.1%	0.2%	160	**Other Materials**	**5.0%**		**758**
Other Ferrous Metals	1.6%	1.0%	249	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.6%	0.9%	93	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.6%	1.1%	247	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**44.4%**		**6,781**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	8.8%	2.3%	1,349	Appliances	0.0%	0.1%	6
Food Waste-Non-Vegetative	15.6%	2.5%	2,384	Covered Electronic Devices	0.1%	0.2%	16
Green Waste	6.5%	3.0%	993	Non-Covered Electronic Devices	0.1%	0.2%	17
Stumps	0.1%	0.1%	13	Auto Fluff	0.1%	0.2%	15
Textiles	4.6%	0.9%	696	Mixed Residues	4.6%	1.2%	705
Carpet	0.0%	0.0%	0				
Other Organics	8.8%	2.0%	1,345	**Totals**	**100.0%**		**15,258**
				Sample Count			**15**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

3 Yard Bins (Front Loaders)

Figure C-9: Overview of Waste: 3-Yard Bins, 2017

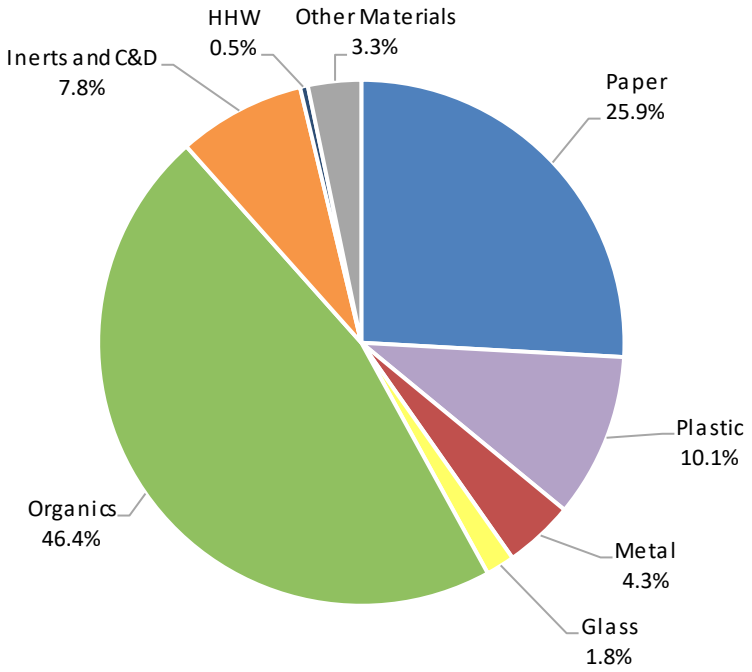

Table C-17: Ten Most Prevalent Material Categories in 3-Yard Bin Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Green Waste	14.5%	14.5%	2,433
Food Waste-Vegetative	12.8%	27.3%	2,139
Food Waste-Non-Vegetative	11.5%	38.8%	1,929
Mixed Recyclable Paper	9.0%	47.8%	1,500
Uncoated Corrugated Cardboard	6.2%	54.0%	1,035
Compostable Paper	6.0%	59.9%	997
Other Plastic Film/Wrap	4.4%	64.3%	739
Treated Wood	4.4%	68.7%	728
Other Organics	3.8%	72.5%	638
Textiles	3.6%	76.1%	597
Subtotal	***76.1%***		***12,734***
All other materials	23.9%		4,007
Total	**100.0%**		**16,741**

Table C-18: Detailed Waste Composition: 3-Yard Bins

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**25.9%**		**4,331**	**Glass**	**1.8%**		**295**
Uncoated Corrugated Cardboard	6.2%	1.1%	1,035	HI-5 Glass Containers	0.4%	0.1%	59
Newspaper	2.1%	0.8%	350	Non-HI-5 Glass Containers	1.2%	0.6%	199
Paper Bags	1.2%	0.3%	193	Other Glass	0.2%	0.2%	37
White and Colored Ledger Paper	0.5%	0.3%	89				
Mixed Recyclable Paper	9.0%	2.3%	1,500	**Inerts and C&D Materials**	**7.8%**		**1,311**
Compostable Paper	6.0%	1.5%	997	Untreated Wood	1.3%	1.8%	224
Other Paper	1.0%	0.5%	167	Treated Wood	4.4%	4.5%	728
				Pallets	0.0%	0.0%	0
Plastic	**10.1%**		**1,689**	Gypsum Wallboard	1.2%	1.9%	198
HI-5 Plastic PET Containers	0.5%	0.1%	79	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.5%	0.2%	77	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	1	Concrete	0.0%	0.0%	0
Non-HI-5 Plastic HDPE Containers	1.0%	0.4%	175	Ceramics	0.1%	0.1%	16
Other Bottles/Containers	1.0%	0.2%	173	Sand/Soil/Rock/Dirt	0.0%	0.0%	3
Mixed Rigid/Durable Plastics	1.4%	0.4%	234	Other C&D Material	0.8%	1.4%	141
Plastic Bags	0.1%	0.0%	24				
Other Plastic Film/Wrap	4.4%	1.0%	739	**Household Hazardous Waste**	**0.5%**		**81**
Expanded Polystyrene	0.7%	0.2%	120	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.4%	0.2%	68	Paints/Adhesives/Solvents	0.2%	0.3%	32
				Household Cleaners	0.0%	0.0%	0
Metal	**4.3%**		**719**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.2%	0.1%	39	Batteries	0.0%	0.0%	1
Non-HI-5 Aluminum Containers and Scrap	0.3%	0.2%	55	Other HHW	0.3%	0.2%	47
HI-5 Bi-metal Containers	0.1%	0.1%	14				
Tin/Steel Containers	0.5%	0.1%	78	**Other Materials**	**3.3%**		**547**
Other Ferrous Metals	1.6%	1.1%	276	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.1%	0.1%	18	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	1.4%	1.1%	240	Industrial Sludges	0.0%	0.0%	0
				Tires	0.4%	0.6%	62
Organics	**46.4%**		**7,769**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	12.8%	5.8%	2,139	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	11.5%	3.1%	1,929	Covered Electronic Devices	0.6%	0.6%	107
Green Waste	14.5%	7.1%	2,433	Non-Covered Electronic Devices	0.2%	0.3%	40
Stumps	0.1%	0.2%	21	Auto Fluff	0.0%	0.0%	0
Textiles	3.6%	1.1%	597	Mixed Residues	2.0%	1.2%	338
Carpet	0.1%	0.1%	12				
Other Organics	3.8%	1.3%	638	**Totals**	**100.0%**		**16,741**
				Sample Count			**20**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Bulky Collection (Rear Loaders)

Figure C-10: Overview of Waste: Bulky Collection, 2017

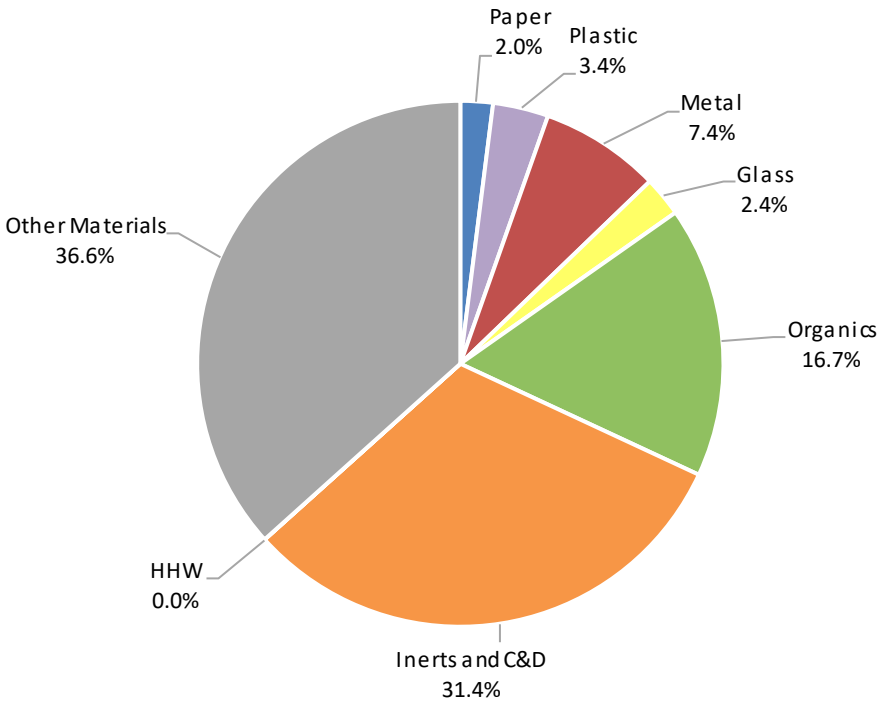

Table C-19: Ten Most Prevalent Material Categories in Bulky Collection Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Furniture	21.0%	21.0%	4,426
Treated Wood	16.3%	37.4%	3,435
Textiles	7.6%	44.9%	1,588
Covered Electronic Devices	6.1%	51.0%	1,279
Other Ferrous Metals	5.0%	56.0%	1,053
Stumps	5.0%	61.0%	1,049
Other C&D Material	5.0%	66.0%	1,044
Untreated Wood	4.4%	70.4%	928
Mixed Residues	3.2%	73.6%	680
Mixed Rigid/Durable Plastics	3.0%	76.6%	628
Subtotal	***76.6%***		***16,111***
All other materials	23.4%		4,915
Total	**100.0%**		**21,026**

Table C-20: Detailed Waste Composition: Bulky Collection

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**2.0%**		**420**	**Glass**	**2.4%**		**515**
Uncoated Corrugated Cardboard	1.1%	0.5%	241	HI-5 Glass Containers	0.0%	0.0%	0
Newspaper	0.0%	0.0%	10	Non-HI-5 Glass Containers	0.1%	0.1%	19
Paper Bags	0.0%	0.0%	7	Other Glass	2.4%	1.0%	496
White and Colored Ledger Paper	0.1%	0.1%	25				
Mixed Recyclable Paper	0.4%	0.2%	74	**Inerts and C&D Materials**	**31.4%**		**6,603**
Compostable Paper	0.1%	0.0%	12	Untreated Wood	4.4%	1.1%	928
Other Paper	0.2%	0.1%	52	Treated Wood	16.3%	5.4%	3,435
				Pallets	0.1%	0.1%	20
Plastic	**3.4%**		**717**	Gypsum Wallboard	2.0%	1.0%	427
HI-5 Plastic PET Containers	0.0%	0.0%	1	Asphalt Roofing	0.0%	0.0%	0
Non-HI-5 Plastic PET Containers	0.0%	0.0%	0	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	0	Concrete	1.1%	0.6%	239
Non-HI-5 Plastic HDPE Containers	0.0%	0.0%	1	Ceramics	0.6%	0.3%	131
Other Bottles/Containers	0.0%	0.0%	4	Sand/Soil/Rock/Dirt	1.8%	1.0%	379
Mixed Rigid/Durable Plastics	3.0%	0.8%	628	Other C&D Material	5.0%	2.6%	1,044
Plastic Bags	0.1%	0.0%	13				
Other Plastic Film/Wrap	0.1%	0.0%	28	**Household Hazardous Waste**	**0.0%**		**2**
Expanded Polystyrene	0.0%	0.0%	4	Pesticides/Herbicides	0.0%	0.0%	0
Other Plastic	0.2%	0.1%	38	Paints/Adhesives/Solvents	0.0%	0.0%	0
				Household Cleaners	0.0%	0.0%	0
Metal	**7.4%**		**1,553**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.0%	0.0%	1	Batteries	0.0%	0.0%	2
Non-HI-5 Aluminum Containers and Scrap	0.0%	0.0%	0	Other HHW	0.0%	0.0%	0
HI-5 Bi-metal Containers	0.0%	0.0%	0				
Tin/Steel Containers	0.0%	0.0%	2	**Other Materials**	**36.6%**		**7,706**
Other Ferrous Metals	5.0%	0.9%	1,053	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	1.6%	0.8%	336	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	0.8%	0.3%	161	Industrial Sludges	0.0%	0.0%	0
				Tires	1.5%	0.6%	321
Organics	**16.7%**		**3,510**	Furniture	21.0%	3.5%	4,426
Food Waste-Vegetative	0.1%	0.1%	30	Appliances	1.9%	2.3%	397
Food Waste-Non-Vegetative	0.1%	0.1%	31	Covered Electronic Devices	6.1%	1.4%	1,279
Green Waste	2.2%	1.6%	469	Non-Covered Electronic Devices	2.9%	1.0%	603
Stumps	5.0%	4.4%	1,049	Auto Fluff	0.0%	0.0%	0
Textiles	7.6%	1.5%	1,588	Mixed Residues	3.2%	0.9%	680
Carpet	1.2%	0.4%	255				
Other Organics	0.4%	0.1%	88	**Totals**	**100.0%**		**21,026**
				Sample Count			**41**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Manual Loads (Rear Loaders)

Figure C-11: Overview of Waste: Manual Loads, 2017

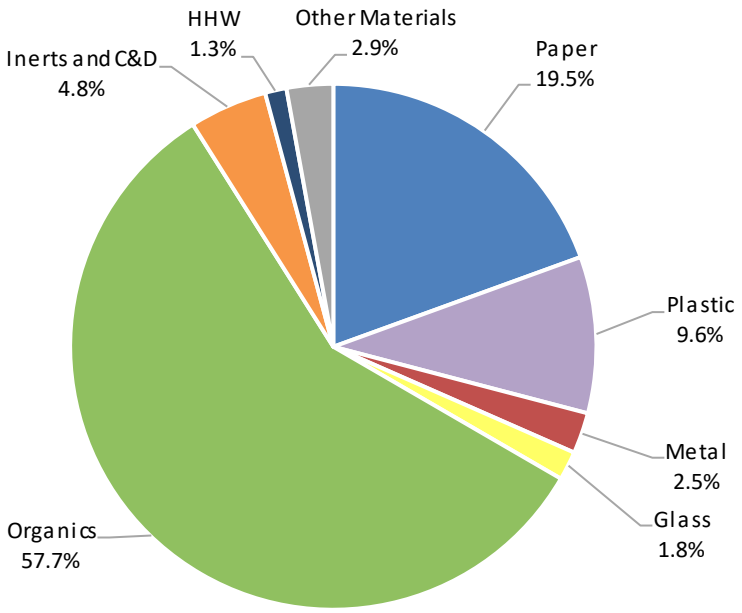

Table C-21: Ten Most Prevalent Material Categories in Manual Load Waste

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Green Waste	29.9%	29.9%	12,855
Food Waste-Non-Vegetative	9.8%	39.8%	4,226
Food Waste-Vegetative	9.5%	49.3%	4,091
Mixed Recyclable Paper	6.3%	55.6%	2,714
Compostable Paper	5.0%	60.6%	2,145
Other Organics	4.8%	65.4%	2,068
Other Plastic Film/Wrap	4.5%	69.9%	1,915
Uncoated Corrugated Cardboard	3.8%	73.7%	1,652
Mixed Residues	2.7%	76.4%	1,142
Textiles	2.6%	79.0%	1,123
Subtotal	***79.0%***		***33,930***
All other materials	21.0%		9,036
Total	**100.0%**		**42,966**

Table C-22: Detailed Waste Composition: Manual Loads

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**19.5%**		**8,360**	**Glass**	**1.8%**		**762**
Uncoated Corrugated Cardboard	3.8%	0.9%	1,652	HI-5 Glass Containers	0.6%	0.3%	257
Newspaper	2.4%	1.4%	1,021	Non-HI-5 Glass Containers	1.1%	0.3%	463
Paper Bags	0.8%	0.2%	364	Other Glass	0.1%	0.1%	42
White and Colored Ledger Paper	0.2%	0.1%	79				
Mixed Recyclable Paper	6.3%	1.1%	2,714	**Inerts and C&D Materials**	**4.8%**		**2,058**
Compostable Paper	5.0%	0.9%	2,145	Untreated Wood	0.3%	0.3%	131
Other Paper	0.9%	0.4%	385	Treated Wood	2.4%	3.4%	1,033
				Pallets	0.0%	0.0%	0
Plastic	**9.6%**		**4,133**	Gypsum Wallboard	0.2%	0.3%	86
HI-5 Plastic PET Containers	0.3%	0.1%	134	Asphalt Roofing	0.1%	0.2%	63
Non-HI-5 Plastic PET Containers	0.4%	0.1%	173	Asphalt Paving	0.0%	0.0%	0
HI-5 Plastic HDPE Containers	0.0%	0.0%	6	Concrete	0.1%	0.1%	30
Non-HI-5 Plastic HDPE Containers	0.8%	0.1%	324	Ceramics	0.1%	0.1%	32
Other Bottles/Containers	1.0%	0.2%	426	Sand/Soil/Rock/Dirt	0.2%	0.4%	102
Mixed Rigid/Durable Plastics	1.0%	0.2%	414	Other C&D Material	1.4%	1.9%	582
Plastic Bags	0.1%	0.0%	37				
Other Plastic Film/Wrap	4.5%	0.8%	1,915	**Household Hazardous Waste**	**1.3%**		**565**
Expanded Polystyrene	0.7%	0.2%	312	Pesticides/Herbicides	0.0%	0.0%	8
Other Plastic	0.9%	0.9%	392	Paints/Adhesives/Solvents	0.0%	0.0%	10
				Household Cleaners	0.0%	0.0%	0
Metal	**2.5%**		**1,082**	Other Automotive Products	0.0%	0.0%	0
HI-5 Aluminum Containers	0.2%	0.1%	80	Batteries	0.1%	0.1%	37
Non-HI-5 Aluminum Containers and Scrap	0.4%	0.1%	155	Other HHW	1.2%	1.7%	510
HI-5 Bi-metal Containers	0.0%	0.0%	19				
Tin/Steel Containers	0.7%	0.2%	292	**Other Materials**	**2.9%**		**1,228**
Other Ferrous Metals	0.8%	0.7%	326	Sewage Sludge	0.0%	0.0%	0
Other Non-Ferrous Metals	0.0%	0.0%	2	Sewage Screenings/Grit	0.0%	0.0%	0
Other Metals	0.5%	0.3%	209	Industrial Sludges	0.0%	0.0%	0
				Tires	0.0%	0.0%	0
Organics	**57.7%**		**24,777**	Furniture	0.0%	0.0%	0
Food Waste-Vegetative	9.5%	2.5%	4,091	Appliances	0.0%	0.0%	0
Food Waste-Non-Vegetative	9.8%	2.8%	4,226	Covered Electronic Devices	0.1%	0.2%	57
Green Waste	29.9%	6.4%	12,855	Non-Covered Electronic Devices	0.0%	0.0%	7
Stumps	0.5%	0.7%	209	Auto Fluff	0.1%	0.1%	23
Textiles	2.6%	0.9%	1,123	Mixed Residues	2.7%	1.0%	1,142
Carpet	0.5%	0.7%	205				
Other Organics	4.8%	1.2%	2,068	**Totals**	**100.0%**		**42,966**
				Sample Count			**21**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

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Appendix D: Composition Calculations

To develop composition and quantity profiles for this study, three main steps were taken. These steps are as follows.

1. Calculate the estimated composition of the waste.
2. Calculate the estimated quantity of waste.
3. Combine composition and quantity estimates using a weighted average procedure.

Each of these steps is described in detail below.

Estimating Compositions

COMPOSITION CALCULATIONS

The composition estimates represent the ratio of the **ratio of the components' weight to the total sample weight** for each noted waste sector (e.g., the percent of newspaper, by weight, of commercial self-haul vehicles).

They are derived by summing each component's weight across the selected records and dividing by the sum of the total sample weight, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where:

r = ratio of components' weight to the total sample weight
c = weight of particular component
w = sum of all component weights
for i 1 to n
where n = number of selected samples
for j 1 to m
where m = number of components

The confidence interval for this estimate is derived in two steps. First, the variance around the estimate is calculated, accounting for the fact that the ratio includes two random variables (the component and total sample weights). The **variance of the ratio estimator** equation follows:

$$\hat{V}_{r_j} = \left(\frac{1}{n}\right) \cdot \left(\frac{1}{\overline{w}^2}\right) \cdot \left(\frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1} \right)$$

where:

$$\overline{w} = \frac{\sum_i w_i}{n}$$

Second, **error rates** at the 90% confidence interval were calculated for a component's mean as follows:

$$r_j \pm \left(t \cdot \sqrt{\hat{V}_{r_j}}\right)$$

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level

VOLUME-TO-WEIGHT CONVERSIONS FOR VISUAL SAMPLES

The composition calculations described above rely on the availability of individual material weights for each sample. For most of the waste examined in this study, weights were gathered by hand-sorting each sample. However, residential bulky collection loads, commercial self-haul loads, and residential self-haul loads from convenience centers were visually characterized.

To convert volumetric estimates to weights for all materials detected in visually characterized samples, Cascadia converted all volumetric estimates to weights using industry-standard waste density factors.

Using the volume-to-weight conversion factors and the volume estimates obtained in the field, individual material weights were calculated using the following formula:

$$c = m * s * v * d$$

where:

m = percentage estimate of the main material class (e.g., *paper*)
s = percentage estimate of the specific material category (e.g., *newspaper*)
v = total volume of the sample (in cubic yards)
d = density conversion of the specific material category (in pounds/cubic yard)

The individual material weights were then aggregated using the calculation procedures described in the first section of this appendix.

Estimating Quantities of the Waste

Cascadia's analysis is based on disposal quantities from September 2016-August 2017. The annual quantity (tonnage) data was provided by the City to generate the estimates presented throughout this report.

Table D-1 summarizes the as-reported annual waste tonnages used for this study.

Table D-1. Summary of Annual Tons (September 2016-August 2017)

Sector	Hauler	Vehicle Type	Collection District/Route Type/Disposal Site	Annual Tons (September 2016-August 2017)
Residential	Refuse Division	Side Loader	Honolulu	52,994.9
Residential	Refuse Division	Side Loader	Kapaa	28,420.7
Residential	Refuse Division	Side Loader	Laie	6,745.9
Residential	Refuse Division	Side Loader	Pearl City	60,791.9
Residential	Refuse Division	Side Loader	Wahiawa	17,709.7
Residential	Refuse Division	Side Loader	Waialua	3,874.0
Residential	Refuse Division	Side Loader	Waianae	15,258.0
Residential	Refuse Division	Front Loader	3 cy Bins (mostly MF)	16,741.2
Residential	Refuse Division	Rear Loader	Bulky Collection	21,025.8
Residential	Refuse Division	Rear Loader	Manual	42,965.7
Commercial	Private haulers	All		400,154.3
Commercial Self-haul	Self-haul	All		65,289.5
Residential Self-haul	Self-haul	All	Convenience Centers	44,762.9
Residential-self-haul	Self-haul	All	Transfer Stations	17,633.8
Total				**794,368.2**

Combining Compositions and Quantities

A *weighted average* calculation was used to estimate the composition of the overall waste stream, overall residential, and overall commercial. This calculation averages the composition of waste from various sectors (strata) and assigns a relative importance (weighting) to samples from each. The weighting groups and associated weighting factors are calculated based on the annual quantities disposed during the baseline period for the study (September 2016 to August 2017) overall and by sector.

The **weighted average for a composition estimate** was performed as follows:

$$O_j = \left(p_1 * r_{j1}\right) + \left(p_2 * r_{j2}\right) + \left(p_3 * r_{j3}\right) + \ldots$$

where:

p = the proportion of tonnage contributed by the noted sector
r = ratio of individual material component weight to total waste weight in the noted sector
for j = 1 to m
where m = number of material components

Appendix E: Sample Field Forms

This appendix contains examples of the field forms used throughout the study including:

- Vehicle selection form for residential City and County-hauled routes.
- Vehicle selection form for systematically selected samples (commercial and self-haul).
- Sample placard.
- Material weight tally sheet.
- Visual characterization form.

Figure E-1: Example Vehicle Selection Form (residential samples)

2017 Oahu Waste Composition Study
Vehicle Selection Sheet

Date:

Goal: **10 Samples**

Sample ID	Yard	Route	Notes
HW-10	Honolulu West	70	
HW-11	Honolulu West	71	
HW-12	Honolulu West	72	
HW-13	Honolulu West	73	
HW-14	Honolulu West	74	
HW-15	Honolulu West	75	
HW-16	Honolulu West	76	
HW-17	Honolulu West	77	
HW-18	Honolulu West	78	
HW-19	Honolulu West	79	

Figure E-2: Example Vehicle Selection Form (commercial and self-haul samples)

2017 Oahu Waste Composition Study
Vehicle Selection Sheet

Site: _____ **Substream:** Privately Hauled Commercial Waste

Date: _____ **Goal:** 5 **Samples Total**

Each number represents an expected vehicle based on the available data.

Cross off one number for each vehicle entering the landfill.

When you reach the number circled, place a pink placard in the windshield and ask this vehicle to go to the sorting area.

Privately Hauled Commercial Waste: **NEED** 5 **TOTAL**

1	2	3	(4)	5	6	7	(8)	9	10	11	(12)	13	14	15	(16)	17	18	19	(20)
21	22	23	24	25	26	27	28	29	30										

(expect 30)

Figure E-3: Example Sample Placard

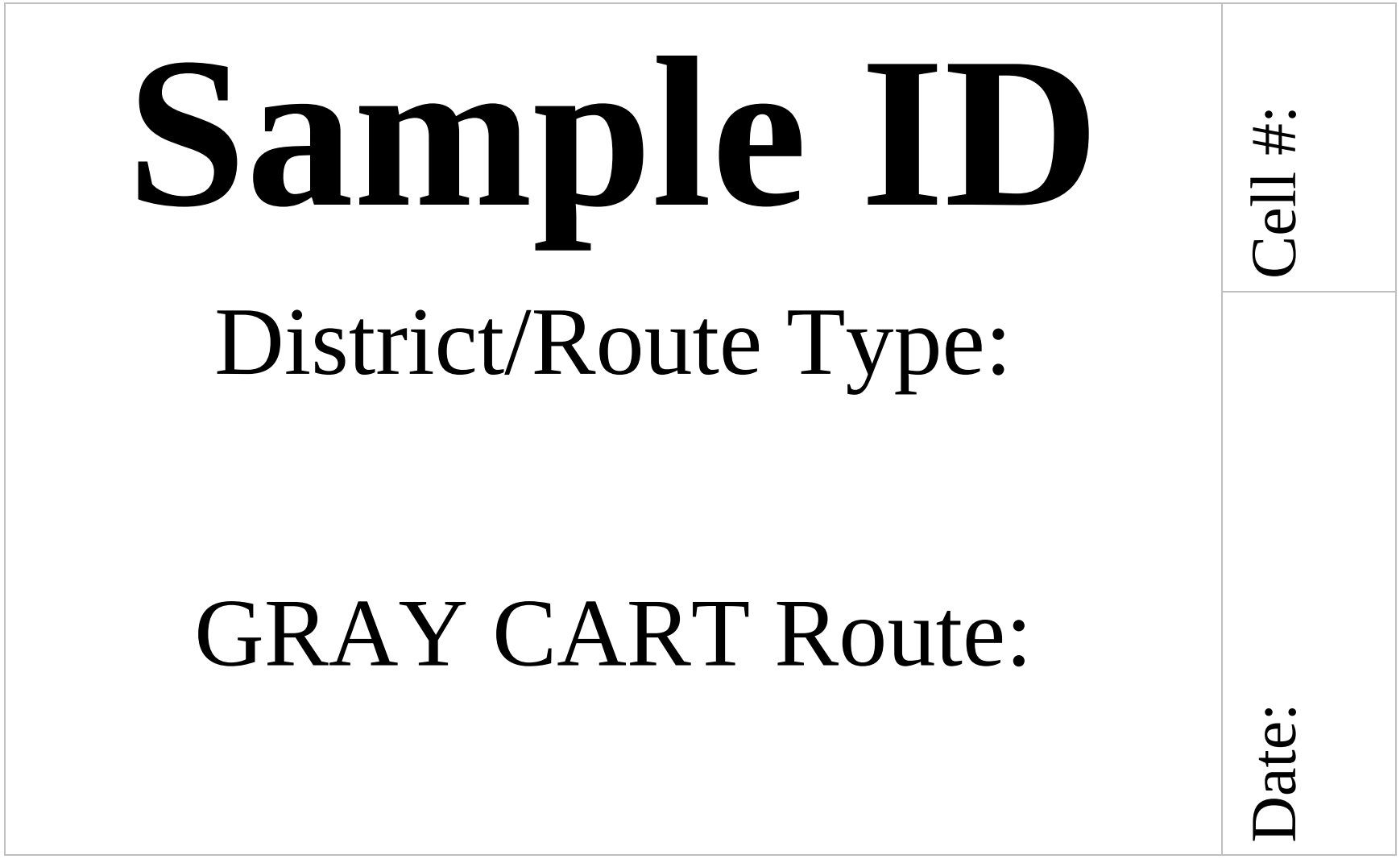

Figure E-4: Material Weight Tally Sheet (Front)

2017 Honolulu Waste Composition Study — Tally Sheet - Page 1

PAPER	Uncoated Corrugated Cardboard				
	Newspaper				
	Paper Bags				
	White and Colored Ledger Paper				
	Mixed Recyclable Paper				
	Compostable Paper				
	Other Paper				
PLASTIC	HI-5 Plastic PET Containers				
	Non-HI-5 Plastic PET Containers				
	HI-5 Plastic HDPE Containers				
	Non-HI-5 Plastic HDPE Containers				
	Other Bottles/Containers				
	Mixed Rigid/Durable Plastics				
	Plastic Bags				
	Other Plastic Film/Wrap				
	Expanded Polystyrene				
	Other Plastic				
METAL	HI-5 Aluminum Containers				
	HI-5 Aluminum Containers and Aluminum Scrap				
	HI-5 Bi-metal Containers				
	Tin/Steel Containers				
	Other Ferrous Metals				
	Other Non-Ferrous Metals				
	Other Metals				
GLASS	HI-5 Glass Containers				
	Non-HI-5 Glass Containers				
	Other Glass				
ORGANICS	Food Waste-Vegetative				
	Food Waste-Non-Vegetative				
	Green Waste				
	Stumps				
	Textiles				
	Carpet				
	Other Organics				

SAMPLE # **DATE:**

YARD: **Honolulu** **Kapaa** **Laie** **Wahiawa** **Pearl City** **Waialua** **Waianae**

DUMP FACILITY: **Hpower** **Keehi TS** **Kapaa TS**

ROUTE #

For COMMERCIAL PRIVATE HAULERS, write hauler name: _____

For COMMERCIAL SELF-HAULS, write company name: _____

VEHICLE TYPE (circle one)

SL Res - Side Loader

FL 3 CY - Front Loader

RL Manual - Rear Loader Manual

RL Bulky - Rear Loader Bulky

Com SH - Commercial Self-Haul

Res Self-Haul - Residential Self-Haul

Material Weight Tally Sheet (Back)

Tally Sheet - Page 2

2017 Honolulu Waste Composition Study

INERTS AND C&D MATERIALS					
	Untreated Wood				
	Treated Wood				
	Pallets				
	Gypsum Wallboard				
	Asphalt Roofing				
	Asphalt Paving				
	Concrete				
	Ceramics				
	Sand/Soil/Rock/Dirt				
	Other C&D Material				

OTHER MATERIALS					
	Sewage Sludge				
	Sewage Screenings/Grit				
	Industrial Sludges				
	Tires				
	Furniture				
	Appliances				
	Covered Electronic Devices				
	Non-Covered Electronic Devices				
	Auto Fluff				
	Mixed Residues				

HOUSEHOLD HAZARDOUS WASTE					
	Pesticides/Herbicides				
	Paints/Adhesives/Solvents				
	Household Cleaners				
	Other Automotive Products				
	Batteries				
	Other HHW				

NOTES:

Figure E-5: Visual Characterization Form

2017 Honolulu WCS Visual Characterization Form

Step 1:

Site: Hpower Keehi Kapaa

OR

Convenience Center: Ewa Wahiawa Waipahu Waianae

Date: _____

Sample ID: _____

Customer (circle one): **Res Self-Haul** **Com Self-Haul** **Bulky Rear Loader**

Step 2: Measure and record the load volume
(Include trailer dimensions if applicable)

Dimensions (vehicle): _____YDS.

or

_____in x _____in x _____in

Dimensions (trailer):

_____in x _____in x _____in

Step 3: Photograph the sample

Step 4: Identify and record all material classes (in bold) that appear in the load.

Step 5: Estimate composition of load by volume for each material class (in bold).

Step 6: For each material class, estimate composition by volume of each material type

Step 7: Make sure material class estimates AND material type estimates EACH total 100%

Photo?

Sample Notes:

Paper: _____%

	Uncoated Corrugated Cardboard
	Newspaper
	Paper Bags
	White and Colored Ledger Paper
	Mixed Recyclable Paper
	Compostable Paper
	Other Paper
%	***Subtotal (must equal 100%)***

Glass: _____%

	HI-5 Glass Containers
	Non-HI-5 Glass Containers
	Other Glass
%	***Subtotal (must equal 100%)***

Metal: _____%

	HI-5 Aluminum Containers
	Non-HI-5 Aluminum Containers and Aluminum Scrap
	HI-5 Bi-metal Containers
	Tin/Steel Containers
	Other Ferrous Metals
	Other Non-Ferrous Metals
	Other Metals
%	***Subtotal (must equal 100%)***

Plastic: _____%

	HI-5 Plastic PET Containers
	Non-HI-5 Plastic PET Containers
	HI-5 Plastic HDPE Containers
	Non-HI-5 Plastic HDPE Containers
	Other Bottles/Containers
	Mixed Rigid/Durable Plastics
	Plastic Bags
	Other Plastic Film/Wrap
	Expanded Polystyrene
	Other Plastic
%	***Subtotal (must equal 100%)***

Grand Total:_____%
(Must equal 100%)

Organics: _____%

	Food Waste-Vegetative
	Food Waste-Non-Vegetative
	Green Waste
	Stumps
	Textiles
	Carpet
	Other Organics
%	***Subtotal (must equal 100%)***

Inerts and C&D Materials: _____%

	Untreated Wood
	Treated Wood
	Pallets
	Gypsum Wallboard
	Asphalt Roofing
	Asphalt Paving
	Concrete
	Ceramics
	Sand/Soil/Rock/Dirt
	Other C&D Material
%	***Subtotal (must equal 100%)***

Household Hazardous Waste: _____%

	Pesticides/Herbicides
	Paints/Adhesives/Solvents
	Household Cleaners
	Other Automotive Products
	Batteries
	Other HHW
%	***Subtotal (must equal 100%)***

Other Materials: _____%

	Sewage Sludge
	Sewage Screenings/Grit
	Industrial Sludges
	Tires
	Furniture
	Appliances
	Covered Electronic Devices
	Non-Covered Electronic Devices
	Auto Fluff
	Mixed Residues
%	***Subtotal (must equal 100%)***